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The Information Content of Dividends and Open-Market Share Repurchases: Theory and Evidence

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Abstract

Since the dividend irrelevance theory of Miller and Modigliani (1961), academics and practitioners still have little understanding of the managerial incentives underpinning dividend policy. Black (1976) observed, “The harder we look at the dividend picture, the more it seems like a puzzle, with pieces that just don’t fit together.”

This thesis aims to shed additional light on the dividend puzzle. Accordingly, two theoretical models have been developed to help explain why firms pay dividends or repurchase their own shares. The models consider the case in which the managers of a high-quality firm (firm *H*) and a low-quality firm (firm *L*) choose to use corporate cash flows to pay dividends, repurchase shares, or invest in a real project from which they can earn private benefits. I focus on the case in which firm *H* has a positive NPV project whereas firm *L* has a negative NPV project.

In the first model, developed in spirit of Isagawa (2000), I show that paying dividends is a dominated strategy for firm *H*, regardless of the managerial weight parameter. If the manager is myopic, firm *L* will choose to repurchase shares at the detriment of existing shareholders. If the manager is farsighted, on the other hand, firm *L* will choose to pay dividends. I also consider the case in which investors are irrational in that they do not update their beliefs upon observing one firm repurchasing shares while the other firm paying dividends. The model shows that, in inefficient market, firm *L* will not mimic given that firm *H* repurchases shares since it cannot obtain any benefit from doing so.

In the second model, built on Fairchild and Zhang’s (2005) work, in which the managerial payout decisions depend on the relative magnitudes of dividend and repurchase catering premia, I demonstrate that a myopic manager of firm *H* may pass up a positive NPV project in order to cater to investor demand for dividends or share repurchases (an adverse selection problem). In addition, I show that the agency cost of free cash flow can be mitigated if the dividend-catering premium is sufficiently

high. That is, firm *L*'s manager will have a strong incentive to return excess cash to shareholders rather than invest it in a negative NPV project.

Then, I investigate dividend changes in Thailand over the period 2002-2005. To test the signalling and free cash flow hypotheses, I first analyse profitability changes around dividend changes and benchmark them with control firms, and examine the relation between dividend changes and the past and future profitability. Consistent with Benartzi et al.'s (1997) evidence in the U.S., dividend changes in Thailand do not signal future profitability but rather the past performance. Then, I examine the determinants of dividend changes and firm's decision to change dividends. I also investigate the short-run and long-run stock price performance of dividend-changing firms, and the relation between announcement returns and hypothesised independent variables. Finally, I examine firms' investment behaviour following dividend changes. The results do not support the view that dividend changes signal future profitability. Overall, the findings are broadly consistent with the free cash flow hypothesis rather than the signalling hypothesis.

Additionally, I provide preliminary evidence on open-market share repurchases (OMRs) in Thailand over the period December 2001 to January 2007. I find that stock prices react positively to OMR announcements and continue to increase in the longer term, suggesting that stock market underreacts to the signal conveyed by the managers of repurchasing firms. Comparing the actual repurchase cost with the costs of benchmark portfolios, I find that the actual repurchase cost is the lowest. This finding suggests that the managers of repurchasing firms have substantial ability to time the market.

CHAPTER 1
Introduction

Since the dividend irrelevance theory of Miller and Modigliani (1961), academics and practitioners still have little understanding of the managerial incentives underpinning dividend policy, and the effect on firm performance and market valuation. Indeed, Black (1976) observed, “The harder we look at the dividend picture, the more it seems like a puzzle, with pieces that just don’t fit together.”

The main aim of this thesis is to shed additional light on the dividend puzzle by focusing on testing the two major competing hypotheses in dividend literature: the signalling hypothesis and the free cash flow hypothesis. The signalling hypothesis states that, under asymmetric information between managers and investors, dividend policy may provide signals regarding the firm’ current performance and future prospects.[1] The free cash flow hypothesis (e.g., Easterbrook, 1984; Jensen, 1986) states that dividend policy helps address agency problems between managers and investors. In Easterbrook (1984), the monitoring role of dividends mitigates agency conflicts between managers and shareholders. In Jensen (1986), the agency problem arises from managers’ incentives to invest in negative NPV projects in order to build their empires. Therefore, dividends alleviate this problem by reducing the free cash flows available to managers. In similar manner, share repurchases[2] can be used to signal the firm’s true value and to disgorge the firm’s free cash flows to shareholders.

Researchers have developed theoretical models regarding the choice between dividends and share repurchases (see, for example, Ofer and Thakor, 1987; Brennan and Thakor, 1990; Chowdhry and Nanda, 1994; Persons, 1997). However, most of the early models on share repurchases focus on the share repurchase tender offers,

[1] See, for example, Bhattacharya (1979), Miller and Rock (1985), and John and Williams (1985).
[2] Over recent decades, share repurchases have become a primary means of returning corporate cash to investors. Grullon and Michaely (2002) reported that while share repurchase expenditures in the U.S. grew at an average annual rate of 26.1% over the period 1980 to 2000, dividends grew only at an average annual rate of 6.8%. In fact, in 1998, U.S. industrial firms spent more money on share repurchases ($181.8 billion) than on cash dividends ($174.1 billion).

which are now relatively less common compared to open-market share repurchases, and consider only the choices of payouts between dividends or stock repurchases while, in practice, the manager may use the firm's excess cash to invest in unprofitable projects in order to earn private benefits. Considering this alternative, Isagawa (2000) develops a signalling model in which the manager chooses between open-market share repurchases and a real investment from which the manager can take private benefits, and then derives a separating equilibrium in which the manager with a high private benefit chooses to invest in a new project while the manager with a low private benefit chooses to repurchase shares.

Isagawa's (2000) model provides a key insight regarding the effect of private benefits on the managerial payout decision. Nevertheless, his model appears to be incomplete in that: (1) it does not include a cash dividend, which is a primary means of corporate payouts; (2) it considers only the case in which the managerial compensation is tied solely to the firm's long-term fundamental value; and (3) it does not consider an increase in managerial equity stake after shares are repurchased.

To fill out these voids, I develop a signalling model in which the managers of a high-quality firm (firm *H*) and a low-quality firm (firm *L*) decide whether to pay out excess cash in the form of dividends or share repurchases, or invest it in a new project from which they can take private benefits. In this model, the managerial compensation is tied to both the short-term market value of the firm immediately after the manager announces his investment/payout policies, and the fundamental value of the firm after the return from investment is realised or the cash flow is returned to investors in the form of dividends or share repurchases. In addition, the managerial equity stake in the firm increases after shares are repurchased.

I focus on the case in which the return on investment for firm *H* is positive whereas the return on investment for firm *L* is negative. That is, firm *H* has a better prospect while firm *L* has a worse prospect. The model is then analysed in three possible cases: (1) the manager assigns equal weight to his short-term and long-term payoffs; (2) the manager assigns more weight to his short-term payoff; and (3) the manager assigns more weight to his long-term payoff.

The results show that, regardless of the managerial weight parameter, paying dividends is a dominated strategy for firm *H*. Therefore, firm *H*'s manager only considers the choice between investing in the new project from which he can also get private benefits and repurchasing undervalued shares from tendering shareholders in order to benefit long-term shareholders. If the manager places equal weight to his short-term and long-term payoffs, there is a separating equilibrium in which firm *H* invests in the new project while firm *L* repurchases shares. If the manager is myopic, repurchasing shares is a dominant strategy for firm *L*. In this case, there is a pooling equilibrium in which both firms repurchase shares. On the other hand, if the manager is farsighted, repurchasing shares is a dominated strategy for firm *L*. In this case, there is a separating equilibrium in which firm *H* invests in the new project while firm *L* pays dividends.

I further consider the case in which investors are irrational in that they do not update their beliefs upon observing one firm repurchases shares whereas the other firm pays dividends. With these small changes in investors' beliefs, there is no pooling equilibrium in which both firms repurchase shares as in the case of efficient market because firm *L* cannot obtain any benefit from sending a false signal to the market.

The second model, developed from Fairchild and Zhang's (2005) work, is a catering model in which two types of firms, a high-quality type and a low-quality type, decide to use cash flows to pay dividends or repurchase shares in order to cater to investor demand, or alternatively, invest in the new project. The model shows that the firm's decision depends on (1) the gain/loss from investment; (2) the manager's time horizon; (3) the relative magnitudes of dividend and repurchasing premia; and (4) the degree of information asymmetry. Both adverse selection and moral hazard problems are addressed in this model.

Specifically, I demonstrate that the high-quality firm's manager may pass up a positive NPV project in order to cater to investor strong demand for dividends or share repurchases (adverse selection problem). On the other hand, the low-quality firm's manager has a strong incentive to return cash flows to shareholders if the catering premia are higher than the private benefits from investing in a negative NPV project. That is, the moral hazard problem is alleviated under this case.

Then, I examine the dividend policy of listed firms in Thailand during 2001-2005. In particular, I focus on testing the two competing hypotheses in dividend literature: the signalling hypothesis and the free cash flow hypothesis. This is an important area of study because the factors affecting dividends are still little understood, especially in an emerging-market context.

Fuller and Thakor (2002) note that both the signalling hypothesis and the free cash flow hypothesis support much of empirical evidence that dividend increases (decreases) are good news, causing stock price to increase (decrease). Many researchers have conducted empirical tests that distinguish between these hypotheses. The signalling hypothesis suggests that announcements of dividend changes are associated with stock returns around announcement days (Asquith and Mullins, 1983, among others) and that any increase in dividends should signal an improvement in future profitability (empirically supported by Aharony and Dotan, 1994; Healy and Palepu, 1988; Nissim and Ziv, 2001, among others; but not supported by Benartzi, Michaely, and Thaler, 1997; DeAngelo, DeAngelo, and Skinner, 1996, among others). In contrast, the free cash flow hypothesis can be tested by considering the relationship between dividend changes, growth opportunities, cash flows, and firms' investment behaviours (see, for example, Denis, Denis, and Sarin, 1994; Lang and Litzenberger, 1989; Yoon and Starks, 1995). I employ these methods to test these two hypotheses in relation to dividend policy in Thailand.

Recently, scholars have developed the life-cycle theory of dividends (see, for example, DeAngelo and DeAngelo, 2006; Fama and French, 2001; Grullon, Michaely, and Swaminathan, 2002). This theory contends that mature and established firms are more likely to pay dividends relative to young firms that have abundant growth opportunities and limited resources. In addition to testing the signalling and the free cash flow hypotheses, I also test the life-cycle hypothesis in relation to dividend policy in Thailand.

Much of the existing empirical analysis examines the dividend policy of firms in the U.S. or in other developed countries and the findings are inconclusive. However, it is being increasingly recognised that dividend policies may be affected by the international context in which they occur. This is emphasised by LaPorta, López-de-Silanes, Shleifer, and Vishny (2000) who examine dividend policies around the world. Research on dividend policies in developing countries (e.g., Aivazian, Booth, and Cleary, 2003) and developed countries (e.g., Denis and Osobov, 2008) suggests that dividend policies vary in different country environments. Hence, further investigations of corporate dividend policies, particularly in a developing country, become important. I therefore look at the dividend policy of Thai firms. According to Aivazian et al. (2003), Thai stock market is classified as underdeveloped and market-oriented. It has a highly concentrated ownership structure, i.e., the three largest shareholders owned an average 47% of the firms compared to 20% in the U.S.[3] These features might lead Thai firms to pursue different dividend policies from firms in the U.S. and other countries. To my best knowledge, no other study has focused on this emerging market in this context.

To test the signalling hypothesis, I examine the relation between dividend changes and past, current, and future profitability; and the relation between dividend changes, earnings, and firm size. To test the free cash flow hypothesis, I examine the relation between dividend changes, growth opportunities, cash flow levels, and investment behaviours following dividend changes. To test the life cycle hypothesis, I examine the relation between dividends and the mix of earned and contributed capital.

[3] See Aivazian, Booth, and Cleary (2003) for more discussions of the distinct feature of Thai firms with respect to control and ownership structure, banks and stock market development, taxation and other institutional factors.

Moreover, I examine the reactions of Thai stock market to announcements of dividend changes.[4] I employ the cumulative abnormal return (CAR) to examine the short-run reactions of stock market to these announcements. I also calculate the buy-and-hold abnormal return (BHAR) to examine the long-run implications of dividend news.

Further, I investigate open market share repurchase (OMR) activities in Thailand from December 2001 to January 2007. According to the signalling theory, share repurchases can be used to signal to investors that the firm's stock price is currently undervalued, causing the stock price to rise. Prior empirical investigations of OMRs in the U.S. (See, e.g., Vermaelen, 1981; Comment and Jarrell, 1991; Ikenberry, Lakonishok, and Vermalen, 1995; Stephens and Weisbach, 1998; and Grullon and Michaely, 2002) document positive stock price change of around 3% surrounding OMR announcements. Recently, research on open market share repurchases has received considerable attentions and grown outside the U.S. (see, e.g., Brockman and Chung (2001) in Taiwan; Rau and Vermaelen (2002) in the U.K.; Zhang (2002) in Japan; Jung et al. (2005) in Korea; Ginlinger and Hamon (2007) in Germany). However, these papers have been conducted using data from developed countries. Little is known about share repurchase activities in emerging countries. Therefore, an investigation of OMRs in Thailand will shed more light on existing literature.

In order to test the signalling hypothesis, I calculate cumulative abnormal return (CAR) to examine the stock market response to open market share repurchase announcements by listed companies in the Stock Exchange of Thailand (SET). In addition, I calculate the longer-term CAR to test whether Thai stock market under-reacts or over-reacts to OMR announcements.[5] I find that the mean CAR of Thai stock market during the 5-day window (-2, +2) is 4.22%. Following the OMR

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[4] Aharony and Swary (1980) and Grullon et al. (2002) demonstrate that an announcement of dividend increase (decrease) pushes up (down) stock prices. Michaely, Thaler, and Womack (1995) find that an announcement of dividend omission has a larger impact on stock prices than that of dividend initiation.

[5] Ikenberry, Lakonishok, Vermaelen (1995) examine OMRs in the U.S. during 1980-1990 and find that stock market, especially value stocks, underreacts to the OMR announcements.

announcements, the stock prices of repurchasing firms show a positive drift of 7.53% and 5.10% over the windows (+3, +120) and (+3, +160) respectively. These findings suggest that the stock prices of repurchasing firms are undervalued and OMR announcements are perceived as good news but the stock market initially underreacts to information conveyed through open-market share repurchase announcements.

Further, I test whether the managers of repurchasing firms exhibit ability to time the market. Following Cook, Krigman, and Leach (2004), I compare the actual cost of repurchasing portfolio with the costs of various benchmark portfolios. The results show that the actual repurchasing cost is lower than the costs of benchmark portfolios, suggesting that the managers of repurchasing firms have substantial ability to time the market.

The rest of this thesis is organised as follows. Chapter 2 reviews the literature related to the payout policy. Chapter 3 presents two theoretical models that demonstrate why firms pay dividends or repurchase shares. Chapter 4 empirically examines the dividend changes in Thailand. Chapter 5 investigates the open-market share repurchase activities in Thailand. Chapter 6 concludes the thesis and provides recommendations for future research.

CHAPTER 2

Literature Review

2.1 Dividend Literature

Why firms pay dividends have long been a puzzle and one of the most important issues in corporate finance. In a celebrated paper, Miller and Modigliani (1961) proposed that dividend policy is irrelevant. That is, it is not important how the firm's cash will be sliced and distributed to shareholders since firm value is not affected by dividend policy.

The Miller and Modigliani's dividend irrelevance proposition is nevertheless based on a number of assumptions in an ideal world without taxes, information asymmetry, incomplete contracts, institutional constraints, and transaction costs. In practice, the dividend policy does matter because the market is not perfect and many factors are crucial and must be considered when management and the board of directors make decisions about the level of dividends and/or how much to repurchase shares which in turn affect the value of the firm.

Much of dividend literature has attempted to explain why firms pay dividends and among the most popular theories that have been tested are the signalling hypothesis and the free cash flow hypothesis. Other theories include the dividend-clientele hypothesis, the life-cycle theory of dividends, and the catering theory of dividends.

2.1.1 Signalling Hypothesis

The signalling theory is based on the notion that management is better informed about the firm's value than outside shareholders. The managers may have good news about their firm's future profitability but the current stock prices do not reflect this because investors have access only to public information (Grullon and Ikenberry, 2000).

Traditional signalling theory shows that payouts convey favourable information about firm's prospects. The best known signalling models are those of Bhattacharya (1979), Miller and Rock (1985), and John and Williams (1985). These models suggest that managers who foresee better performance can send positive signal to the market by paying out dividends today because they are confident that future capital requirements can be financed by future earnings. On the other hand, managers who do not expect any improvement in profitability are refrained from doing so because they might have to forego profitable investments or raise costly external funds in the future.

Bhattacharya (1979) develop a two-period model in which manager maximises existing shareholders' wealth and shareholders have a single-period planning horizon. At date zero, manager invests in a project and also committed to pay dividends. At date one, the cash flow from the investment at date zero is realised and used to pay dividends. The crucial assumption of this model is that if the cash flow at date 1 is insufficient to meet the committed dividends, the firm will have to raise external funds, which is costly due to the high transaction costs and much costlier than benefits from signalling by dividends at date zero. Hence, it is not worthwhile for a firm with bad project to send a (false) signal to shareholders by announcing dividends. Only does a firm with good project signal its quality via a dividend announcement.

Miller and Rock (1985) develop a signalling model through the sources and uses of funds. In their model, a dividend announcement serves merely as a signal about the firm's current earnings, which, in turn, the market uses as a basis for estimating the firm's future earnings. The cost of signalling by increasing dividends is the forgone use of funds in productive investment. Hence, in equilibrium, good firms are able to announce dividends to signal that their earnings are good enough to justify dividends whereas it is not worthwhile for bad firms to do so since adverse consequences from losing investment opportunities far outweigh benefits from short-run stock price appreciation.

As noted by Allen and Michaely (2003), the signalling models of Bhattacharya (1979) and Miller and Rock (1985) do not explain why firms do not signal their quality at a lower cost by repurchasing shares instead of paying dividends. John and Williams (1985)'s model partially answers this question. At time zero, managers invest in a project and simultaneously announce dividends. The asymmetric information between managers and shareholders is the firm future cash flow and, accordingly, the firm's present value. At time one, cash flow from the investment is realised, and dividends are paid to shareholders. Shareholders must pay a tax on dividend but not on capital gain. It is assumed that the firm's shareholders have liquidity needs so that they must sell some of their shares either cum-dividend or ex-dividend and managers always act to maximise current shareholders' wealth.

By signalling with dividends, managers can increase the share price and thereby reduce dilution of the current stockholders. For stockholders of more valuable firms, the marginal benefit from reducing dilution is greater than the marginal cost of tax on dividends. The opposite is true for stockholders of less valuable firms. Consequently, managers of more valuable firms signal their inside information with larger dividends. Hence, it is the cost of tax on dividends, if it is high enough, that separates good firms from bad firms. This is a reason why firms pay dividends rather than repurchase shares.

2.1.2 Free Cash Flow Hypothesis

The Free Cash Flow Hypothesis is primarily based on the argument that there is a conflict of interest between managers and shareholders. That is, rather than act in shareholders' best interests, managers could allocate the firm's resource to benefit themselves (Jensen and Meckling, 1976). Managers' selfish behaviours can include lavish spending on luxurious office and unjustifiable mergers and acquisitions. Hence, free cash flows can create overinvestment problem because they may be used to fund negative NPV projects. To mitigate the overinvestment problem, Easterbrook (1984) and Jensen (1986) suggest that firms return cash to shareholders either by paying dividends or repurchasing shares, thereby reducing the amount of cash that will be wasted by managers.

An implication of the free cash flow hypothesis is that firms that are mature with high free cash flow tend to have overinvestment problem. Thus, rather than signalling their better profitability, a dividend increase by these firms may convey information that the overinvestment problem is alleviated, causing stock price to increase. Conversely, a dividend decrease by such firms conveys information to the market that more negative NPV projects will be undertaken, causing stock price to decline.

2.1.3 Empirical Tests of Signalling Hypothesis

Lintner (1956) was one of the first researchers offering empirical support to the signalling hypothesis. He finds that managers tend to increase dividends when they are confident that cash flows in the future will be sufficient to cover the higher rate of payments and that managers decrease dividends only when the cash flows are insufficient to justify the present dividend rate.

Examining the market reactions to dividend change announcements, Pettit (1972) find that the market reacts dramatically to dividend cuts or substantial dividend increases, but not very strong to moderate dividend increases. These results of asymmetric market reactions to dividend changes are consistent with Lintner's (1956) finding that managers are reluctant to decrease dividends. In addition, Pettit finds that substantial information about the firm's earnings is conveyed by announcements of dividend changes and that a dividend announcement may convey significant information to the market beyond that already contained in contemporaneous earnings numbers. Hence, Pettit's findings lend support to the signalling hypothesis.

To test the hypothesis that dividends contain information about the future earnings of the firm, Watts (1973) examine the relationship between unexpected changes in dividend and changes in future earnings of 310 U.S. firms between 1947 and 1966. On average, his regressions suggest a positive relationship between the unexpected dividend changes and future earnings changes. However, the relationship is not strong, i.e., the average size of future earnings changes is very small. Further, he examines the relationship between stock price changes and unexpected dividend changes. Despite a positive relationship between these variables, Watts conclude that the informational content of dividend changes is trivial because even the one with superior information about dividend changes cannot use this information to earn abnormal returns.

Charest (1978) study the efficiency of stock market with respect to quarterly dividend announcements. His findings show significant abnormal returns surrounding and following a dividend increase announcement. Since his study does not control for the information conveyed by contemporaneous earnings announcements, Charest concludes that his findings do not necessarily indicate that dividend announcements do convey valuable information to shareholders.

Aharony and Swary (1980) argue that the disagreement among previous empirical studies stems from a difficulty in identifying the information content of dividends. That is, dividend and earnings announcements are often made simultaneously. To better examine whether dividends contain information, therefore, they analyse only the cases where dividend announcement date differs from earnings announcement date by at least 11 days. Employing such a methodology, they find that stock market reacts positively to dividend increases but negatively to dividend decreases, and that the market reactions to dividend increases and decreases are not symmetrical. In particular, abnormal returns around dividend decreases are of much greater magnitude than those around dividend increases. Further, Aharony and Swary find that firms announcing both earnings and dividend increases in the same quarter earned significant positive abnormal returns at the earnings announcement dates regardless of whether these earnings announcements precede or follow the dividend increase announcements. Therefore, they conclude that their findings strongly support the hypothesis that a dividend change does provide useful information about the firm's future prospects beyond that provided by earnings numbers.

Asquith and Mullins (1983) analyse a sample of 168 firms that either pay the first dividend in their corporate history or resume paying a dividend after a hiatus of at least 10 years. Their findings demonstrate that a dividend initiation provides a large and significant positive excess return. Compared with dividend increases, dividend initiations cause larger stock market reactions. However, the average size of dividend initiations is also larger than dividend increases. Adjusting for the size of dividend changes, dividend increases appear to generate as large as or larger excess returns than do dividend initiations. The finding that the announcement return is significantly related to the magnitude of dividend change is consistent with the signalling theory. Overall, their results support the view that dividends convey valuable information to investors.

In an examination of 131 firms that initiated dividends, Healy and Palepu (1988) find that earnings of these firms increased rapidly in the past and continued to increase for the two years following dividend initiations, the evidence consistent with the signalling theory. However, the results from their analysis of 172 firms that omitted dividends show that earnings of these firms declined in the year of dividend omission announcements but significantly improved in subsequent years, the findings in contrast with the signalling hypothesis.

Aharony and Dotan (1994) test whether quarterly dividend announcements convey useful information about future earnings beyond that provided by quarterly earnings announcements. In particular, they examine the association between unexpected changes in quarterly dividends and unexpected earnings in subsequent quarters. Their results indicate that firms that increased (decreased) dividends experience higher (lower) unexpected earnings in subsequent periods than do firms that did not change dividends. These findings are consistent with the signalling hypothesis.

Bernheim and Wantz (1995) test the dividend signalling theory under various tax regimes. In particular, they examine whether abnormal returns to dividend change announcements are higher when factors such as tax rates, bond ratings, and capacity utilisation suggest that the marginal costs of dividend signalling are high. They find that announcement returns increase with dividend tax rate, decrease with bond ratings, and increase with capacity utilisation, the findings in support of the signalling hypothesis.

Analysing a sample of 145 NYSE companies whose earnings decline after nine or more consecutive years of growth to study the signalling content of dividends, DeAngelo, DeAngelo, and Skinner (1996) find no evidence that dividend increases are associated with subsequent earnings surprises. They also test whether dividend increases help separate firms with relatively good earnings prospects from firms with relatively poor earnings prospects. However, they find no evidence in support of this separating equilibrium hypothesis. In a further examination of managers' letters to stockholders, they find that most managers are overly optimistic about their firm's future prospects. Hence, they conclude that dividends are not reliable signals about the firms' future prospects because of managerial over-optimism and modest cash commitments from dividend increases.

Benartzi, Michaely, and Thaler (1997) investigate a large sample of 1,025 firms and 7,186 firm-year observations to determine whether dividend changes have information content about earnings. They find that dividend-increasing firms experienced significantly positive earnings growth in one year before (year -1) and in the year in which dividend change takes place (year 0), but show insignificant earnings growth in subsequent years. In addition, the magnitude of dividend increase is not significantly related to the future earnings. In contrast, dividend-decreasing firms experienced a decline in earnings in year -1 and year 0, but show a significant increase in earnings in year 1.

Further, Benartzi et al. find some evidence that dividend-increasing firms are less likely to experience decreases in subsequent earnings than firms that keep dividends unchanged, despite similar earnings growth for these two groups. Overall, their findings show no support for the signalling hypothesis. That is, dividend changes do not signal the future but rather the past and concurrent earnings. If there is any information content of dividend change, it is about the permanent shift in earnings as suggested by Lintner (1956).

In contrast with Benartzi et al. (1997), Nissim and Ziv (2001) argue that dividend changes indeed convey new information about future profitability. They note that Benartzi et al. (1997) do not find significant relationship between dividend changes and future earnings primarily because two specification issues related to the estimation of unexpected earnings: measurement error and omitted correlated variables. To address these issues, Nissim and Ziv deflate earnings change by the book value of common equity rather than the firm's market value, and add the ratio of earnings to the book value of equity (ROE) in their regression models. As a result, they find that dividend changes are positively related to earnings changes in each of the two years following the dividend change, and that dividend changes are positively related to the level of future profitability. Accordingly, they conclude that their findings lend support to the signalling hypothesis.

As a response to Nizzim and Ziv's (2001) findings, Grullon et al. (2005) employ a large sample of 2,778 firms, 14,235 dividend increases, 947 dividend decreases, and 23,334 no-change events to re-examine the relation between dividend changes and changes in future profitability. Controlling for the nonlinear patterns in earnings behaviour, Grullon et al. find no significant relation between dividend changes and future earnings changes, a finding in contrast with that of Nizzim and Ziv (2001). In addition, they find that dividend changes are negatively correlated with future changes in profitability (return on assets). In a further investigation of whether the models including dividend changes improve the earnings forecasts, they find that the models that include dividend changes do not outperform the models that do not include dividend changes. Therefore, they conclude that dividends changes do not signal changes in future earnings and profitability.

Comparing dividend policies of U.S. and Japanese firms, partitioned into keiretsu-member, hybrid, and independent firms, Dewenter and Warther (1998) find that U.S. firms experience stronger stock market reactions to dividend initiation and omission announcements than do Japanese firms. In addition, they find a significant relation between announcement return and dividend yield for U.S. firms, but insignificant relation between these variables for Japanese firms. Moreover, they find that, in response to poor earnings performance, U.S. firms are more reluctant to omit and cut dividends than Japanese firms. According to these results, they conclude that Japanese firms, particularly keiretsu-member firms, are subject to less information asymmetry and agency conflicts than U.S. firms.

Using data of Japanese firms to test the signalling hypothesis, Fukuda (2000) find that dividend-increasing firms experience significant earnings growth in one year before and in the dividend-change year but experience earnings declines in subsequent years. In contrast, earnings of dividend-decreasing firms and dividend-omitting firms decline in the year before dividend announcement but subsequently recover. Further, he finds that the stock market reacts positively to dividend increases and initiations but negatively to dividend decreases and omissions although these market reactions are contradicted by the subsequent earnings performance. He concludes that it is possible investors are overly optimistic about the future earnings and overreact to dividend increases and initiations, and that his findings do not support the signalling hypothesis.

Kato, Loewenstein, and Tsay (2002) test the signalling hypothesis and the free cash flow hypothesis of dividend policy in Japan. Their results indicate that the announcement return is positively related to the magnitude of dividend change and to Tobin's Q ratio, but negatively related to firm size. Also, dividend changes are related to cash flows from operations, financing, and investment activities. Dividend-increasing firms have higher earnings, lower debt ratios, and higher investments after dividend announcements. In contrast, dividend-decreasing firms have lower earnings, higher debt ratios, and lower investments. In particular, they demonstrate that dividend changes not only signal the past and the current earnings but also the future earnings, the findings consistent with the signalling theory. However, they find that average announcement return of firms with higher *Q* value is higher than that of firms with lower *Q* value, a result inconsistent with the free cash flow hypothesis. Overall, their findings support the signalling hypothesis rather than the free cash flow hypothesis.

Harada and Nguyen (2005) also examine dividend policy of Japanese firms. They argue that the information content of dividends depends on the context in which the dividend changes take place. In particular, they find that firms that increase dividends in a favourable context (i.e., a positive earnings trend) have significantly higher earnings growth than firms that increase dividends in an unfavourable context (i.e., a poor earnings trend). Additionally, in an unfavourable condition, firms that are reluctant to cut dividends (i.e., keeping their dividends unchanged) subsequently underperform firms that cut dividends in the first place. Considering the context of dividend changes, Harada and Nguyen find a significant association between dividend changes and subsequent earnings changes. Hence, they conclude that their findings are broadly supportive of the signalling hypothesis.

Li and Zhao (2008) study how informational asymmetries affect firms' dividend policy. Using analyst earnings forecast errors and the dispersion in analyst forecasts to measure the degree of information asymmetry between managers and investors, they find that firms with more transparent information environments pay more dividends, a finding in contrast with the signalling hypothesis. They further examine the relation between the quality of a firm's information environment and total payout that include both dividends and share repurchases but do not find a positive relation between the degree of information asymmetries and total payout. Hence, their results are not consistent with the signalling hypothesis.

2.1.4 Empirical Tests of Free Cash Flow Hypothesis

An implication of the free cash flow hypothesis is that cash-rich firms that are mature with scarce investment opportunities tend to have overinvestment problem. Thus, a dividend increase announcement by these firms should be accompanied with a positive stock market reaction since it is a signal to shareholders that management will not wastefully use corporate cash flows. Lang and Litzenberger (1989) focus on testing this feature of the free cash flow hypothesis, and contrast it with the signalling theory. Empirically, they use Tobin's *Q* ratio to determine the group of overinvesting firms. Particularly, the Tobin's *Q* less than one implies overinvestment problem while the Tobin's *Q* more than one indicate that a firm is undertaking the value-maximising level of investment.

Using a sample of 429 regular dividend changes between 1979 and 1984, Lang and Litzenberger find that the average announcement return of large dividend change is significantly higher for firms with low Tobin's *Q* than for firms with high Tobin's *Q*. This evidence is consistent with the free cash flow hypothesis that dividend increases by overinvesting firms signal management's intention to mitigate overinvestment problem, thereby causing larger stock market reaction. Further, their analysis of changes in analysts' earnings forecasts surrounding dividend announcements indicate that the effect of dividend announcements on earnings expectation is not statistically significant, a finding inconsistent with a prediction of signalling hypothesis. Overall, their results are more consistent with the free cash flow hypothesis than the signalling hypothesis.

In an examination of 55 self-tender offers and 60 special dividend announcements between 1979 and 1989, Howe, He, and Kao (1992) find no significant association between announcement returns and Tobin's *Q*, a finding in contrast with that of Lang and Litzenberger (1989). In more refined tests, they regress the announcement returns against the firm's cash flow before the event and an interaction term between Tobin's *Q* and cash flow. However, the results fail to capture a significant relation between announcement returns and the firm's potential to overinvest. Therefore, their findings offer no evidence supporting the free cash flow hypothesis.

Yoon and Stark (1995) employ Tobin's *Q* to test whether the information conveyed by dividend change announcements is more consistent with the signalling theory or the free cash flow hypothesis. Examining a sample of 4,179 dividend changes between 1969 and 1988, they find that the stock price reaction to dividend change announcements is more consistent with the signalling hypothesis. Their results show that the average abnormal return of low-*Q* firms is significantly higher than that of high-*Q* firms for dividend increases. However, there is no difference in the magnitude of stock price reactions between these two groups after controlling for the size of dividend change, the dividend yield, and the market value of the firm. This result is in contrast with that of Lang and Litzenberger (1989) who find a significantly higher stock price reaction for low-*Q* firms than for high-*Q* firms.

Their examination of the firms' capital expenditures after dividend changes indicates that there are significant increases (decreases) in capital expenditures following dividend increases (decreases) for firms regardless of their investment opportunities, the results inconsistent with the free cash flow hypothesis. They further examine the revisions of analysts' forecast for current earnings and find that dividend change announcements cause analysts to revise their forecast for current earnings in the manner consistent with the signalling hypothesis. Overall, Yoon and Stark's (1995) findings are more consistent with the signalling hypothesis than the free cash flow hypothesis.

Using a sample of 6,777 dividend changes between 1962 and 1988 to examine the relation between dividend change announcements and stock price reactions, Denis, Denis, and Sarin (1994) find that abnormal returns around dividend changes are positively related to the magnitude of dividend changes and to the level of dividend yield, but unrelated to Tobin's *Q*. In addition, their results indicate that analysts revise their forecasts of future earnings following dividend change announcements and that low-*Q* firms actually increase (decrease) capital expenditures following dividend increases (decreases). Collectively, their findings support the signalling hypothesis rather than the free cash flow hypothesis.

Investigating 570 special dividends, 7,417 regular dividend increases, and 207 self-tender offers, Lie (2000) find that firms tend to have excess funds before the payout announcements and that the stock price reaction to these announcements is significantly related to excess funds and the firm's investment opportunities, as measured by Tobin's *Q*, for self-tender offers and large special dividends but not for regular dividend increases and small special dividends. Overall, his results are consistent with the free cash flow hypothesis, i.e., cash payouts help curtail potential overinvestment by managers.

Chen, Jian, and Xu (2009) investigate dividend policies of listed firms in China from 1990 to 2004. Specifically, they aim at exploring why some Chinese listed firms pay outs high dividends, despite the weak investor's protection in China. Their evidence shows that high dividend payments are used to divert corporate cash to controlling shareholders who receive substantial discount of non-tradable shares during the IPO. Thus, dividends may not be used only for signalling profitability or mitigating agency costs of free cash flow but also for tunnelling purpose in China.

2.1.5 Maturity Hypothesis and the Life-cycle Theory of Dividends

In a comprehensive investigation of a large sample of 7,642 dividend change announcements between 1967 and 1993, Grullon, Michaely, Swaminathan (2002) find that profits of dividend-increasing firms do not increase but instead decline after dividend increases, while those of dividend-decreasing firms show a tendency to recover after dividend decreases rather than decline further, the findings in contrast with the signalling hypothesis. In addition, they find that dividend-increasing firms do not increase their capital expenditures in the years after dividend increases. Moreover, the systematic risk of dividend-increasing firms significantly declines around dividend increase announcements, resulting in a significant decline in their cost of capital. Grullen et al. indicate that this decline in systematic risk is a significant determinant of the positive stock price reaction to dividend increases. Further, they find a permanent increase in the dividend payout ratios of dividend-increasing firms. The result that these firms can maintain higher dividends is consistent with Lintner's (1956) finding that managers attempt to smooth dividends. Following these findings, Grullon et al. propose the maturity hypothesis, positing that a firm tends to increase dividends as it move from a growth phase to a more mature phase. As a growth firm becomes mature, its investment opportunities decline, which, in turn, would lead to an increase in the firm free cash flows. A mature firm then pays out these free cash flows in the form of dividends or share repurchases. Therefore, a dividend increase may signal not only a change in the firm's fundamental but also a commitment of management not to overinvest.

2.1.6 Dividend Clientele Hypothesis

Allen, Bernado, and Welch (2000) contend that firms pay dividends because dividends attract institutional investors, who pay less dividend tax than do retail investors. Typically, institutional investors are more likely than retail investors to conduct "due diligence" to find out whether a firm is efficiently run. Moreover, institutions have been increasingly involved in corporate governance in recent years. Therefore, institutional holdings can increase firm values because they are better able to monitor and control management actions. In particular, Allen et al. develop a signalling model to show that management can use dividends to signal that the firm is good because paying dividends increase the likelihood that firm quality will be detected by the institutions. Therefore, bad firms will not find it worthwhile to pay dividends to mimic good firms because bad firms do not want their quality to be detected.

Grinstein and Michaely (2005) examine the relation between institutional holdings and payout policy in the U.S. between 1980 and 1996. They find that institutions prefer dividend-paying firms to non-dividend-paying firms. However, within dividend-paying firms, institutions are not attracted to firms that pay high dividends, a finding inconsistent with the prediction of Allen et al. (2000) that high dividends attract institutional holdings. In addition, they find that firms that repurchase more shares attract institutions, and that institutions prefer regular repurchasers to nonregular ones. Moreover, their findings indicate that higher institutional holdings do not lead to higher dividends, repurchases, or total payout. Collectively, their results do not support the notion that high dividends attract institutions or higher institutional holdings cause firms to increase payout.

Baba (2009) investigates the impact of the increase presence of foreign investors on dividend policies of a sample of 847 Japanese firms listed on the Tokyo Stock Exchange. He finds that a higher level of foreign ownership raises the probability of dividend payouts and dividend increases but lowers the probability of no dividend changes and dividend decreases. Thus, these results demonstrate that foreign investors have significant influence on dividend payout decisions of Japanese firms.

2.1.7 Catering Theory of Dividends

In a seminal paper, Baker and Wurgler (2004a) propose the catering theory of dividends, stating that manager's decision to pay dividends is driven by the premium investors place on dividend-paying firms. That is, managers cater to investors by paying dividends when investors put a premium on dividend payers, but not paying dividends when investors prefer non-dividend payers. They develop a model in which the manager trades off between a short-run stock price affected by investor demand for dividends and a long-run fundamental value determined by investment policy. The model predicts that the propensity to pay dividends is increasing in the dividend premium (i.e., the difference between the current stock prices of payers and nonpayers) and decreasing in the fundamental cost of dividends (e.g., costly external finance or taxes).

Li and Lie (2006) extend Baker and Wurgler's (2004a) dividend catering model by including dividend increases and decreases. They argue that while Baker and Wurgler's (2004a) model might explain why some firms initiate or omit dividends, it cannot explain why firms change dividend level. In addition, insignificant relationship between announcement returns and dividend premiums in Baker and Wurgler (2004a) casts doubts about the validity of the catering theory. Consequently, Li and Lie assume that investors categorise firms into groups not only on whether they pay dividends but also on the dividend level. Li and Lie find that both the probability of dividend increases and decreases and the magnitude of dividend changes are related to dividend premium. In particular, when the dividend premium is high, firms are more likely to increase dividend and when the dividend premium is low, firms are more likely to decrease dividends and repurchase shares. Moreover, they find that the announcement returns for dividend increases are positively related to the dividend premium while the announcements returns for dividend decreases are negatively related to the dividend premium.

In a recent study, Ferris, Jayaraman, and Sabherwal (2009) test the catering theory of dividends across a sample of twenty-three countries. They find that, compared with that in civil law countries, dividend policy in common law countries is more driven by investor's demand for dividends because shareholders in common law countries have a higher level of legal protection, requiring the managers to be more responsive to investor's demand for dividends while, in civil law countries, the managers are less responsive to minority shareholders' demand because they are disciplined by large controlling shareholders who have less interest in exploring the market misevaluations of their firms' stock prices due to dividend policy.

2.1.8 Propensity to Pay Dividends

Fama and French (2001) study the propensity to pay dividends of U.S. firms between 1926 and 1999. They find that the percentage of firms paying dividend declines substantially after 1978, i.e., the proportion of dividend payers reaches its peak of 66.5% in 1978 but falls to only 20.8% in 1999. Their evidence indicates that the lower proportion of dividend payers is, in part, due to a surge in new listings of small firms with low profitability but high investment opportunities that never pay dividends. In sum, they demonstrate that U.S. firms have become less likely to pay dividends, regardless of their characteristics.

DeAngelo, DeAngelo, and Stulz (2006) test the life-cycle theory by examining whether the probability to pay dividends is related to the earned/contributed capital mix, as measured by retained earnings to total equity (RE/TE) or retained earnings to total assets (RE/TA). Typically, firms with low RE/TE (RE/TA) tend to be in the growth stage and reliant on external capital while firms with high RE/TE (RE/TA) tend to be more mature with high accumulated profits, thus making them good candidates to pay dividends. Consistent with the life-cycle theory, their evidence indicates that the earned/contributed capital mix has a positively significant relation with the probability that a firm pays dividends, controlling for firm size, current and lagged profitability, growth, total equity, cash balances, and dividend history. This relation also holds for the probability that a firm initiates or omits dividends. In addition, DeAngelo et al. document a substantial increase in firms with negative retained earnings from 11.8% in 1978 to 50.2% in 2002, a finding that further explains why U.S. firms have lower propensity to pay dividends during such period as documented by Fama and French (2001).

Ferris et al. (2006) investigate whether U.K. firms have lower propensity to pay dividends. They find that the number of U.K. firms paying dividends declines from 75.9% in 1988 to 54.5% in 2002 and that the number of new lists paying dividends declines from 60.2% to 28.6% during the same period. Controlling for firm size and profitability, they find that the decreases in dividend payers appear to be concentrated over the 1998-2002 period. To explain this change in dividend policies, Ferris et al. examine dividend premium of U.K. firms and find that catering incentives appeared to shift in the U.K. during the late 1990s. They conclude that this change in catering incentives most likely explain why fewer U.K. firms pay dividends.

In a recent paper, Denis and Osobov (2008) examine cross-sectional and time-series evidence on the propensity to pay dividends in several developed financial markets (the U.S., Canada, the U.K., Germany, France, and Japan) over the period 1989-2002. Like Fama and French (2001), they find that the likelihood of paying dividends is associated with firm size, growth opportunities, and profitability. In all six countries, the likelihood of paying dividends is strongly associated with the ratio of retained earnings to total equity. The fraction of firms that pay dividend is high when this ratio is high and low when retained earnings are negative. Consistent with the U.S. evidence reported by DeAngelo, DeAngelo, and Skinner (2004), their evidence in six countries shows that aggregate dividends do not decline overtime but concentrated among the largest and most profitable firms, the finding consistent with the life-cycle theory's prediction that the distribution of free cash flow is the primary determinant of dividend policy. In addition, they test the catering theory by examining the relation between the propensity to pay dividends and the Baker and Wurgler's (2004a, b) dividend premium. Their evidence, however, fails to provide much support for the catering theory of dividends outside the U.S.

Eije and Megginson (2008) examine dividends and share repurchases in the European Union from 1989 to 2005. They find that the number of European firms paying dividends declined while the total dividends and share repurchases increased dramatically over such period. In addition, they find the positive relation between financial reporting frequency and corporate payout policies. That is, the financial reporting frequency of EU companies has increased from 1.2 to 2.4 times per year, which is positively associated with higher payouts.

Andreas, Betzer, Goergen, and Renneboog (2009) investigate dividend policies of 220 German firms from 1984 to 2005. They document that, compared to UK and US firms, German firms pay out a lower proportion of their cash flows but a higher proportion of their published earnings as dividends. The authors find that dividend payout ratios of German firms are based on cash flows rather than published earnings and that dividend policies of German firms are more flexible than those of UK and US firms; that is, German firms are more willing to cut or omit dividends as they experience a temporary decline in profitability. Overall, dividend payouts in Germany tend to be subject to a high degree of discreteness as opposed to smoothness observed in the US and the UK.

2.2 Share Repurchase Literature

Several potential explanations for the positive announcement returns and the manager's motives associated with share repurchases have been provided in the finance literature. These include signalling hypothesis, free cash flow hypothesis, capital structure adjustment hypothesis, financial flexibility hypothesis, dividend substitution hypothesis, options funding hypothesis, wealth redistribution hypothesis, and takeover deterrence hypothesis. Recent studies also examine managerial timing ability, which is associated with market underreaction hypothesis.

2.2.1 Signalling Hypothesis

One of the most leading explanations for the positive abnormal returns to share repurchase announcements and why firms repurchase shares in academic literature is the signalling hypothesis, which is based on the notion that the management is better informed about the firm's value than outside shareholders. The information asymmetry between insiders and outsiders can lead to the occasions where managers have good news about future profitability but prevailing stock prices do not reflect this because investors have access only to public information (Grullon and Ikenberry, 2000).

Traditional signalling theory shows that payouts convey favourable information about firm's prospects. Bhattacharya (1979) and Miller and Rock (1985) suggests that managers who foresee better performance can send positive signal to the market by paying out dividends today because they are confident that future capital requirements can be financed by future earnings. On the other hand, managers who do not expect any improvement in profitability are refrained from doing so because they might have to forego profitable investments or raise costly external funds in the future. Therefore, the signalling theory also suggests that managers can use a share repurchase announcement to signal information about future cash flows and firm undervaluation (see, e.g., Dann, 1981; Ofer and Thakor, 1987; Constantinides and Grundy, 1989).

An implication of the signalling hypothesis is that, if management's principal motive is to signal their optimism about the firm's future profitability, repurchasing firms should experience improvement in future earnings and cash flows. However, the empirical tests of the signalling hypothesis provide mixed results. For example, Choi and Chen (1997) study the difference in the private information conveyed by the announcement of a share repurchase tender offer and of a regular dividend increase. They find that a share repurchase tender offer leads to higher earnings forecasts by analysts than does a regular dividend increase. In addition, they find a permanent decline in the firm's systematic risk following a share repurchase tender offer. Thus, when the managers foresee a relatively large increase (decrease) in the firm's earnings (risk), a share repurchase tender offer may be adopted rather than a regular dividend increase.

Nohel and Tarhan (1998) examine the performance of a sample of 242 tender offers between 1978 and 1991. Their results show that there is a significant improvement in the performance of repurchasing firms following share repurchase announcements. However, the improvement in performance comes from deployment of existing assets rather than from new investment opportunities. In addition, their results show a decline in systematic risk following share repurchases. The changes in systematic risk are negatively related to the announcement period abnormal returns but positively related to long-run returns. These findings suggest that the long-run performance is driven by a decline in systematic risk rather than by increased operating cash flows.

Examining a sample of 185 announcements of open-market repurchase programmes between 1978 and 1986, Bartov (1991) find that analysts revise upward their earnings forecasts for repurchasing firms and that the earnings for repurchasing firms improve during the announcement year. Likewise, Lie (2005b) document that operating performance of repurchasing firms improves following 4,729 announcements of open-market share repurchase programmes from 1981 to 2000.

In contrast, Jagannathan and Stephens (2003) examine open-market repurchase announcements over the period 1991 to 1995 but find no evidence of improved operating performance following repurchases. Further, the earnings of repurchasing firms fall in the years after these events. Likewise, Grullon and Michaely (2004) examine a sample of 4,443 open-market share repurchase announcements of U.S. firms for the period 1980 to 1997 but find no evidence that repurchasing firms experience an improvement in future profitability relative to their peers. On the contrary, some performance measures indicate that repurchasing firms underperform their peers. In addition, analysts revise their expectations downward after the announcements of share repurchase programme. Accordingly, Jagannathan and Stephens (2003) and Grullon and Michaely (2004) conclude that the signalling hypothesis cannot explain the positive market reaction around open market share repurchase announcements.

The mixed results of improvement in operating performance after the announcements of open market share repurchases raise an important question whether the managers really intend to signal that their firms are undervalued as often cited as a main reason why they announce share repurchase programmes. To test whether managers possess private information about the firm's prospects, Lee, Mikkelson, and Partch (1992) examine managerial trading around share repurchase tender offers. They find that managers increase buying and reduce selling of their firm's shares prior to fixed-price tender offers that do not follow takeover-related events, and that managers tend to decrease selling shares prior to fixed-price tender offers that are followed by takeover-related events, suggesting that managers intend to signal their private information to the market. However, Lee et al. do not detect any unusual managerial trading before Dutch auction offers.

D'Mello and Shroff (2000) examine whether repurchasing firms are in fact undervalued relative to their "economic value" (EV), which is estimated as the sum of book values and discounted future abnormal earnings. Their findings indicate that, at the beginning of the fiscal year in which the tender offer is announced, the estimate of EV of 74 percent of the repurchasing firms is higher than the prevailing stock price; the median magnitude of undervaluation prior to the repurchase is substantial (30%) when compared to the tender premium (21%); and the announcement-period market reaction (12%). Therefore, their results suggest that repurchasing firms are undervalued relative to their EV perceived by managers. This is consistent with the notion that managers want to use share repurchase programmes to signal the undervaluation of their firms' share prices. Further, D'Mello and Shroff analyse the insiders' trading made in the pre-repurchase year of fixed-price tender offers. They find that insiders of undervalued firms are net buyers whereas insiders of overvalued firms are net sellers. This trading pattern is more pronounced in the six-month period before the announcement date. Also, the analysts revise their earnings forecasts upward following a repurchase announcement. Consistent with findings by Lee et al. (1992), these results suggest that managers announce share repurchase programmes to reveal their favourable private information.

2.2.2 Free Cash Flow Hypothesis

If managers do not intend to signal undervaluation, so what explains the positive announcement returns of share repurchases? Another favourable explanation is the Jensen's (1986) free cash flow hypothesis. According to this hypothesis, the agency cost between managers and shareholders increases as the firm has higher free cash flows because managers are more likely to overinvest the firm's excess cash in negative NPV projects. Therefore, a share repurchase programme is good news for shareholders because it decreases the likelihood that the managers will burn the corporate cash flows.

Numerous studies have focused on testing the signalling hypothesis versus the free cash flow hypothesis of share repurchases. For example, Howe, He, and Kao

(1992) examine the announcements of tender offer share repurchases and specially designated dividends (SDDs) to determine whether the free cash flow hypothesis has explanatory power for the positive price response surrounding such corporate announcements. They divide the sample consisting 55 tender-offer repurchases and 60 SDDs using Tobin's *Q* ratio into low-*Q* (over-investing) and high-*Q* (value-maximising) firms. Howe et al. find that the market's reaction to share repurchases and SDDs is approximately the same for both high-*Q* and low-*Q* firms. Further, they test whether low-*Q* firms with greater free cash flows have higher announcement returns. Nevertheless, the free cash flow measure adds little to the explanation of these returns. Therefore, these results are consistent with the signalling hypothesis rather than the free cash flow hypothesis.

As previously discussed, Grullon and Michaely (2004) find no evidence that repurchasing firms experience improvement in future profitability relative to their peers. On the contrary, some performance measures indicate that repurchasing firms underperform their peers. In addition, analysts revise their expectations downward after the announcements of share repurchase programme. Nevertheless, their empirical findings provide support for the free cash flow hypothesis. They find that repurchasing firms reduce their current level of capital expenditures and research and development (R&D) expenses. In addition, the level of cash reserves significantly decline. Moreover, the market reaction to share repurchase announcements is stronger among those firms that are more likely to overinvest. These findings indicate that firms increase their cash payouts in response to a decline in their investment opportunities. Finally, they investigate the relation between the change in the cost of capital and the long-term drift observed after share repurchase announcements. They find that the long-term drift is negatively associated with declining in risk and the cost of capital of repurchasing firms.

Chan, Ikenberry, and Lee (2004) evaluate both the initial market reaction and the longer-term price performance using a comprehensive sample of over 5,000 repurchases announced in the U.S. in the 1980s and the 1990s. They find some support for the signalling hypothesis. Prior to a repurchase announcement, the market receives negative information shocks in the form of negative earnings surprises. Over a four-year window after the announcement, however, earnings surprises tend to be positive and significant. Controlling for size and book-to-market effects, they find that the mean four-year abnormal buy-and-hold return is as high as 23.56%. This suggests that real, unanticipated information is revealed after repurchase announcements and that the initial market reaction is biased and incomplete. Chan et al. find limited support for the free cash flow hypothesis. Their evidence shows that repurchasing firms tend to have above average free cash flows compared to their industry peers, and the long-run drift is greater for high free cash flow firms compared to low free cash flow firms. However, the gains for high free cash flow firms are not linked to the actual share repurchases in order to disgorge the firms' free cash flows to shareholders.

Espenlaub, Lin, Strong, and Wang (2006) test the free cash flow and signalling hypotheses by using a sample of 5,159 repurchase announcements by 301 U.K. firms during September 1997 to July 2003. They find that the profitability of repurchasing firms does not improve after actual share repurchases, but the capital expenditures and cash reserves decrease. In addition, they find no relation between repurchase size and post-event operating performance. Overall, their results are inconsistent with the signalling hypothesis but in line with the free cash flow hypothesis.

Li and McNally (2007) examine the role of firm characteristics and insider private information in affecting Canadian firms' repurchase decision and the associated announcement period stock returns. They find that firms are more likely to buy back shares if they have greater free cash flows, lower market-to-book ratios, poor prior stock performance, and large insiders' shareholdings. In addition, they find that the announcement period returns are strongly and positively related to the private information possessed by company insiders about the agency cost of free cash flows.

2.2.3 Choice between Dividends and Share Repurchases

Modigliani and Miller's (1961) seminal work demonstrates that, in a perfect capital market, the vale of the firm is independent of the firm's payout policy, implying that dividends and share repurchases are perfect substitutes. Since the market is imperfect, however, the firm's choices between paying dividends and repurchasing shares affect the firm's value differently. At least with respect to the tax efficiency, firms should repurchase shares rather than pay dividends because share repurchases, generally treated by tax authorities as capital gains, are taxed at a lower rate than dividends. However, it has been a puzzle why firms pay dividends despite its tax disadvantage relative to share repurchases, as an alternative means of cash distribution to stockholders.

Several researchers attempt to explain this puzzle from theoretical perspective. For example, Ofer and Thakor (1987) develop a signalling model in which managers can signal their firms' true values by using either a dividend or a share repurchase (tender offer) or both. Dividends and share repurchases are costly because they may require external financing in the future when the firms need to make investments. In addition, share repurchases causes the risk-averse manager to have a higher risk exposure due to increased holdings of his or her own firm's shares. These differing signalling cost structures between dividends and share repurchases define the usefulness of each signal in different situations. The model shows that when the difference between the true value of an undervalued firm and its market value is relatively low, the firm chooses to signal by dividends because the associated signalling cost is relatively lower than that of a share repurchase. However, when the true value of the firm is much higher than its market value, the firm chooses to signal by share repurchases because a relatively large dividend is needed for informationally consistent signalling. Thus, only a firm that perceives a relatively large undervaluation will repurchase its shares, whereas a firm with a small undervaluation will pay dividends. Ofer and Thakor conclude that both dividends and repurchases will generally be used as signals and neither dominates the other under all circumstances.

Brennan and Thakor (1990) develop a model explaining why dividends are better form of payout compared with share repurchases. When some shareholders are better informed about the prospects of the firm than others, a share repurchase programme will allow them to take advantage of this information asymmetry. That is, they can repurchase shares at the prices lower than the fundamental value. Consequently, uninformed investors will be worse off. When firms distribute cash in the form of dividends, both informed and uninformed investors will do equally because they receive a pro rata amount. As a result, uninformed investors prefer dividends to share repurchases.

Hausch and Seward (1993) develop a model to show the properties of stochastic (e.g., a share repurchase) and deterministic (e.g., a cash dividend) payout policies. In their model, the firm's choice of signalling with a dividend or a share repurchase depends on the firm's absolute risk aversion. Since decreasing absolute risk aversion means that the firm has more cash available and lower cost of using a share repurchase, the high-quality firm can distinguish itself from the low-quality firm using a share repurchase programme.

Chowdhry and Nanda (1994) propose that it is the fact that a tender offer repurchase causes large stock price increase that makes it unattractive means of payout. As a result, firms distribute some cash in the form of dividends despite the tax disadvantage. The authors develop a model in which the firm may choose not to repurchase shares despite the tax advantage. In this model, it is assumed that managers have more information about the value of the firm's assets in place than outsiders; dividends increase with the level of accumulated cash; and the expected level of dividends or the size of share repurchase next period is positively related to the level of dividends in the current period and to the level of unexpected earnings next period. With these assumptions, the model shows that firms that repurchase less often will have higher stock price reaction associated with a share repurchase announcement.

Jain, Shekhar, and Torbey (2009) examine the choice of payout initiation adopted by 1,886 IPO firms over the period 1990-2000. Their results indicate that dividends and share repurchases are used by different types of firms under different circumstances. In particular, they find that most IPO firms prefer share repurchases to dividends as payout initiation mechanism. IPO firms are more likely to choose repurchases over dividends when they have strong demand for external funds, venture capital backing, and high product market competition. On the other hand, IPO firms prefer dividends to repurchases when investor demand for dividends is high and when they have reached a certain maturity stage.

2.2.4 Models on Open-Market Share Repurchases

Ikenberry and Vermaelen (1996) explain an open-market share repurchase announcement as an option to exchange market value of the firm's stock for its true value. The share repurchase programmes allow managers to use the firm resource along with their insider information to benefit long-term shareholders by buying back shares when they perceive the stock as undervalued.

Similarly, Oded (2005) consider an open-market share repurchase as an option to repurchase shares. He constructs two versions of signalling model to explain why firms announce open-market repurchase programmes. In his single-firm-type version, the firm receives an option to buy back shares once it announces a share repurchase programme. The value of the option is its opportunity to use private information to repurchase shares in the future. The firm will exercise the option to buy only if the stock price is undervalued. Since the outside shareholders (bidders) know they are exposed to adverse selection, they are unwilling to pay high prices and lowering their bids, causing stock price to decline. In a competitive market, the option value and the loss from the decrease in share price exactly offset each other in present value. Hence, a share repurchase programme does not generate an announcement return. In the model comprising two types of firms, a good firm has higher expected value and higher variance than a bad firm. When good firm announces a share repurchase programme, it is long the option to repurchase whereas the market is short this option. It is assumed that the current stock prices are set such that, for good firm, the losses of short-term shareholders exactly offset the gains of long-term shareholders. If bad firm mimics, its long-term shareholders will only receive the option value of a bad firm, which is lower because of lower variance, and the gains from this option cannot offset the losses of short-term shareholders. Thus, a bad firm is better off not announcing share repurchase programme.

Bhattacharya and Dittmar (2004) develop a cheap talk model to explain a situation where an undervalued firm uses an open market share repurchase programme as a costly or costless signal, depending on whether the firm actually repurchases it own shares. They show that, under costless signalling, an undervalued firm can separate itself from an overvalued firm by attracting scrutiny from speculators. Hence, the overvalued firm will not mimic because it does not gain from being discovered. Under costly signalling, which involves spending money, an undervalued firm can separate itself from an overvalued firm because it is costlier for the overvalued firm to mimic. Thus, it is evident that an undervalued firm would like to separate itself by using costless signal rather than costly signal. Bhattacharya and Dittmar demonstrate that a separation by costless signal works only if the benefits from scrutiny are high enough. That is, the firm is deeply undervalued and largely ignored, thereby increasing potential trading profit for a speculator.

2.2.5 Financial Flexibility Hypothesis

Since an open-market repurchase programme does not commit the firm to repurchase shares, it provides more flexibility than dividend announcement, which is irrevocable and commit the firm to maintain or raise level of dividend payments in the future. A recent survey of financial executives by Brav, Graham, Harvey, and Michaely (2005) shows that many managers now favour share repurchase programme because of its flexibility. This flexibility allows managers to alter payout in response to the availability of good investment opportunities. Also, managers believe that share repurchases can be used to time the market, to increase earnings per share, or to offset stock option dilution.

Jagannathan, Stephens, and Weisbach (2000) examine firms' decisions to pay out cash flows in the form of dividends or open-market share repurchases. They find that share repurchases and dividends are used at different times by different kinds of firms. While dividends grow smoothly, share repurchases vary considerably with the business cycle. Firms with higher permanent operating cash flows are more likely to pay dividends while firms with higher temporary, non-operating cash flows are more likely to repurchase shares. Thus, the flexibility feature of share repurchase programme is one reason why firms choose to repurchase shares rather than pay dividends.

Likewise, Guay and Harford (2000) hypothesise that firms increase dividends to distribute relatively permanent cash flows and repurchase shares to distribute transient cash flows. They find that the cash flow shocks followed by substantial dividend increases are more permanent than those followed by share repurchases or small dividend increases or by no payout at all, and that the market updates its assessment about the permanence of the cash flow shock when the payout method does not match its expectations. These findings indicate that managers use payout methods to signal information about the permanence of the cash-flow shock. Finally, these authors conclude that both payout methods send fundamentally different signals and that neither dominates the other.

Lie (2005) examines the effect of financial flexibility and the level and certainty of operating performance on firms' choices to change dividends, pay special dividends, and repurchase shares. He finds that the current income improvement is higher for firms that increase dividends than for firms that repurchase shares, while the past volatility of operating income are lower and subsequent volatility of operating income declines more significantly for firms that increase dividends or pay special dividends than for firms that repurchase shares. These results suggest that managers prefer share repurchases when faced with a volatile income because share repurchases do not commit payouts in the future, thereby providing more flexibility than dividend increases or special dividends.

2.2.6 Dividend Substitution Hypothesis

Due to the dramatic growth of share repurchases over recent years, it is possible that firms have been substituting dividends with share repurchases. Bagwell and Shoven (1989) argue that the surge in share repurchases in the mid-1980s indicates that firms have substituted repurchases for dividends in order to lower tax from cash dividend payments. Subsequent tests of substitution hypothesis produce mixed results, however. For example, Jagannathan et al. (2000) find that dividends are paid out of permanent cash flows while share repurchases are paid out of temporary cash flows and that share repurchases do not appear to replace dividends but rather they complement dividend role in paying out short-term cash flows.

Fama and French (2001) report that, from 1978 to 1999, the proportion of firms paying cash dividends falls from 66.5% to 20.8%. One reason stems from changing characteristics of publicly traded firms; i.e., a number of small firms with low profitability and strong growth opportunities have been increasingly listed in the U.S. stock market. Interestingly, firms have become less likely to pay dividends whatever their characteristics. However, Fama and French find no evidence that declining dividends has been replaced with increasing share repurchases. Rather, most repurchasing firms are dividend paying firms.

A recent study by Ferris et al. (2006) shows that U.K. firms have a lower propensity to pay dividends, i.e., the number of U.K. firms paying dividends declines from 75.9% in 1988 to 54.5% in 2002. However, the authors find no evidence that U.K. firms substitute share repurchases for dividends. On the contrary, Grullon and Michaely (2002), examining the corporate payout policy in the U.S. over the period 1972 to 2000, show that (1) share repurchases have become an important form of payout for U.S. corporations; (2) share repurchases have replaced dividends; and (3) share repurchases has helped stabilise the average payout ratio of firms despite the decline in the dividend payout ratio. In addition, Grullon and Michaely find that dividend forecast errors are negatively correlated with share repurchase activity, a result consistent with the predictions of the substitution hypothesis. Moreover, they find that the market reaction around the announcement of dividend decreases is significantly less negative for repurchasing firms than for non-repurchasing firms. This evidence further supports the notion that share repurchases and dividends are close substitutes.

2.2.7 Options Funding Hypothesis

Recently, there is much evidence that managers buy back shares in order to offset the dilution effect of stock options granted by the firms. For example, Weisbenner (2000) document that, while share repurchases have risen during 1990s, the use of stock options has also increased. For the S&P 500 firms, the stock option grants rose from 1.0% of shares outstanding in 1994 to 1.6% of shares outstanding in 1998. Over four-year period, the size of stock option programmes grew over 40%, with outstanding stock options representing 6.3% of shares outstanding at the end of 1998. Weisbenner shows that an increase in stock option grants is positively related to an increase in share repurchases and total payouts but an increase in executive stock options increase the likelihood that firms cut total cash distribution. In addition, Weisbenner finds that firms gradually repurchase shares over the life of options in order to offset the dilution effects caused by past stock option grants. This evidence is corroborated by Weston and Siu (2003) who find that a primary motive of repurchasing firms in the 1990s was to offset the dilution effects of the exercise of stock options.

Fenn and Liang (2001) examine data on more than 1,100 non-financial firms during 1993-1997 to find out how corporate payout policy is affected by managerial stock options. They find a positive relation between managerial stock options and payouts by firms with high agency problem, i.e., firms with high free cash flows but low investment opportunities. This result suggests that managerial stock options help mitigate the agency cost of free cash flows. In addition, Fenn and Liang find a positive relation between managerial stock options and share repurchases, a finding suggest that the growth in share repurchases is driven by managerial stock options.

Kahle (2002) examine open market share repurchases over the period 1993-1996 to determine the effect of stock options on firm's decision to repurchase shares and stock market reaction to share repurchase announcements. Kahle find that firms repurchase shares in order to fund employee stock options programmes. However, the market appears to recognise this corporate motive and, as a result, reacts less positively to share repurchases announced by firms with high numbers of employee stock options.

2.2.8 Wealth Redistribution Hypothesis

Share repurchases can lead to the wealth transfer between informed shareholders and uninformed shareholders when the stock prices are lower than their fundamental values because the informed shareholders will gain from buying undervalued shares from uninformed investors. Brennan and Thakor (1990) argue that the wealth redistribution between informed and uninformed shareholders in a share repurchase programme creates different incentives between larger shareholders and small shareholders in acquiring the information. That is, with a fixed cost of information acquisition, large shareholders have a greater incentive to collect the information than small shareholders because large shareholders can obtain more trading profits. As a result, wealth is likely to be transferred from small shareholders to large shareholders in a share repurchase programme.

Maxwell and Stephens (2003) argue that a share repurchase programme not only transfers wealth from uninformed to informed shareholders, but also transfers wealth from bondholders to shareholders. They find that share repurchases lead to positive stock returns but negative bond returns. In addition, they find that bond returns are more negative and stock returns are more positive for large repurchase programmes. Moreover, bond ratings are more likely to be downgraded than upgraded following share repurchase announcements, and downgrades are more likely for firms announcing large repurchase programmes.

In a recent paper, Jun, Jung, and Walking (2009) test the signalling hypothesis and wealth transfer hypothesis surrounding share repurchase announcements using a sample of 366 open market stock repurchases from 1991 to 2002. Consistent with Maxwell and Stephens (2003), they find positive returns for shareholders but negative returns for bondholders during share repurchase announcements. However, the wealth losses for bondholders are significant only in the case where share repurchases are associated with options funding while the gains are most likely to be transferred to shareholders of firms with non-investment grade debt. In addition, share repurchases announced by firms with poor governance cause greater losses for bondholders but higher returns for shareholders.

2.2.9 Takeover Deterrence Hypothesis

Managers can buy back shares via fixed-price tender offers or Dutch auctions to fend off takeover attempts. However, open-market repurchases do not appear to fulfil such purpose because of their much smaller in size and higher uncertainty in acquiring the shares from outside shareholders.

Denis (1990) examines the use of special dividends or share repurchases in response to hostile corporate control activity. In share repurchases, managers may choose not to sell their shares in the tender offer, while in special dividend plans, managers typically receive additional shares instead of cash. Both types of payouts can result in the concentration of voting power in the hands of managers and, consequently, high rate of success in maintaining target firm independence. This evidence indicates that announcements of defensive repurchases are typically associated with negative changes in wealth of target firm shareholders while special dividend plans are associated with abnormal wealth increases for target firm shareholders.

Bagwell (1992) constructs a model in which the firm uses share repurchase as a takeover deterrence. The model demonstrates that, in an upward sloping supply curve for shares, a share repurchase by target firm can increase takeover cost to the acquirer; that is, shareholders with the lowest stock valuations are most likely to tender their shares first while remaining shareholders with higher stock valuations may not be willing to tender shares, thereby raising the cost of takeover.

Persons (1994) develops a model of repurchase tender offers in which firms choose between the Dutch auction and the fixed price offers. The model shows that Dutch auction repurchases are more effective in fending takeovers because they eliminate the uncertainty about how many shares will be repurchased while fixed price repurchases are more effective signals of undervaluation because the concavity of fixed price tender offers makes it more costly for overvalued firms to send a false signal to the market

Billett and Xue (2007) examine whether the open market share repurchases have the deterrent effect on takeovers. Specifically, they test whether firms repurchase shares when the probability of becoming the target is high before the firms receive actual bids. Their results show that firms repurchase shares to defend takeover. In addition, firms repurchase shares to distribute temporary non-operating cash flows rather than permanent operating cash flows.

2.2.10 Tax Hypothesis

According to Miller and Modigliani (1961), dividends and share repurchases are equivalent in a perfect capital market. In real world, however, dividends are generally taxed more heavily than capital gains. Hence, share repurchases are apparently superior to dividends. Nevertheless, dividends continue to be a significant means of corporate payouts. This has long been an enigma in corporate finance.

Bernheim (1991) argues that a good firm can separate from a bad firm because dividends are taxed more heavily than share repurchases. In his model, the firm adjusts the proportion of the total payout in the form of dividends as opposed to repurchases in order to control the amount of taxes paid. A good firm can choose optimal amount of taxes to provide the signal to the market.

Chowdhry and Nanda (1994) and Lucas and McDonald (1998) consider models where there is a tax disadvantage to dividends and adverse selection cost to repurchase. In their models, the payout policy depends on whether managers think the firm is overvalued or undervalued relative to the current market price.

Allen, Bernado, and Welch (2000) explain why firms prefer dividends to share repurchases. Because institutions are taxed relatively less than individual investors, dividends attract institutional investors. Typically, institutions are more likely than retail investors to conduct "due diligence" to find out whether a firm is well run. In addition, institutions have been increasingly involved in corporate governance in recent years. Therefore, the presence of institutional holdings can increase firm values because of signalling effects, agency cost effects, or both. Allen et al. develop a signalling model to show that management can use taxable dividends to signal that the firm is good because paying dividends increase the likelihood that firm quality will be detected by the institutions. Bad firms will not find it worthwhile to mimic good firms because they do not want their quality to be detected. In addition, Allen et al. develop an agency model to show that dividends attract informed institutions whose presence ensures that management will manage the firm efficiently. If management underperforms, institutions will facilitate takeovers by selling large blocks of shares or even become directly involved in the corporate governance process. This model shows that dividends are smoothed because dividend reductions would induce some actions by institutional shareholders.

2.2.11 Capital Structure Adjustment Hypothesis

Manager may use share repurchases to adjust the firm's capital structure by increasing the leverage. While repurchase tender offers can provide an immediate and a dramatic change in capital structure, open market repurchases, which are much smaller in size and take several months or years to complete, do not appear to have a significant effect on capital structure. Therefore, open market share repurchases are unlikely to be motivated by capital structure explanation.

2.2.12 Liquidity Effects and Managerial Timing Ability

Several papers focus on examining the liquidity effects of share repurchases and timing ability of managers. However, these papers provide mixed results. For example, Barclay and Smith (1988) examine bid-ask spreads of 153 open market share repurchase announcements from 1970 to 1978. They find that the bid-ask spreads are higher in the year following the announcements than in the year preceding the announcements. Therefore, they conclude that open-market share buyback programmes deteriorate the liquidity of shares.

Consistent with Barclay and Smith (1988), Brockman and Chung (2001), investigating the timing of open market repurchases and the impact on firm liquidity using the data from the Stock Exchange of Hong Kong, find that the bid-ask spreads widen during repurchase periods. In addition, they find that the managers of repurchasing firms exhibit substantial timing ability and that adverse selection costs increase substantially as investors respond to the presence of informed managerial trading.

On the contrary, Cook, Krigman, and Leach (2004), using 64 firms' voluntarily disclosed repurchasing trading data during 1993 and 1994 to examine the timing and execution of open market repurchases of U.S. firms, document that repurchase trading increases market liquidity. In particular, they compare days when repurchase trades are executed to surrounding non-repurchase days and find that quoted spreads are narrower on repurchase days than on days immediately preceding and following a repurchase. For NASDAQ firms, spreads narrow substantially by more than 11 cents per share, compared to a pre-repurchase announcement trading period.

Further, Cook et al. examine other short-term motives for the daily repurchase decision including cost minimisation, price support, and the strategic use of firm-specific information. To evaluate the success of the cost-minimisation strategy, they compare the cost of the realised repurchase portfolio with several naïve accumulation strategies and find mixed results. The larger firms (NYSE firms) generally perform very well from a cost-minimisation perspective while the smaller firms (NASDAQ firms) tend to pay relatively high prices for their shares. Consistent with price support perspective, the results show that firms repurchase following price drops and prices stabilise following repurchase trades. Finally, Cook et al. examine whether firms repurchase shares to take profit from firm-specific information and find that firms repurchase shares when prices have fallen but find no clear evidence that repurchasing firms are able to time the market. In addition, firms significantly decrease repurchase activity in the five-day window around firm-specific announcements, suggesting that firms avoid trading on short-term information.

Investigating 36,848 repurchases made by 352 French firms, Ginglinger and Hamon (2007) find that the share repurchases have an adverse effect on liquidity as measured by bid-ask spread or depth. Further, they examine whether the managers of French firms exhibit timing ability, i.e., the managers use private information to repurchase stock before the share price rises. They find that French firms buy back shares following the falling in share prices, but there is no significant increase in stock prices afterward. Overall, their results indicate that share repurchases in France largely reflect managerial motives to stabilise share prices rather than take advantage of decline in share prices.

2.2.13 Market Underreaction Hypothesis

In an efficient stock market, the share prices of firms adjust immediately to the information as soon as it is revealed to the market participants. This implies that the information asymmetry between insiders and outsiders can be resolved at the announcements of share repurchase programme. If the market is efficient, however, there is no reason why an undervalued firm will buy back shares after the announcements since the share price already increases to its fundamental value and the firm cannot earn any capital gain from share repurchases. Several empirical studies indicate that the market is slow to react to the information conveyed by the managers via open-market repurchase announcements so that the managers have incentives to buy back shares even after the announcements.

Ikenberry, Lakonishok, and Vermalen (1995) argue that the positive initial return of 2-3% around share repurchase announcements is not much greater than the daily standard deviation of returns of many stocks, and that, if managers repurchase shares because of mispricing, they should react when they perceive a substantially larger undervaluation. Hence, Ikenberry et al. hypothesise that the market underreacts to share repurchase announcements, leading prices to adjust slowly over time. They refer to this as the underreaction hypothesis. Empirically, Ikenberry et al. examine a sample of 1,239 open market share repurchases announced between 1980 and 1990. They find that the average market response to the announcements is only 3.5%, but the average four-year buy-and-hold return measured after the initial announcements is more than 12%. For the high book-to-market firms, or value stocks, the average four-year buy-and-hold return is substantially high at 45.3%. For the low book-to-market firms, or growth stocks, no abnormal returns are observed in the long run. Therefore, at least with respect to value stocks, this evidence supports the underreaction hypothesis and consistent with manager's claims of stock undervaluation.

To re-examine the underreaction hypothesis, Ikenberry, Lakonishok, and Vermaelen (2000) study open market share repurchases in Canada from 1989 to 1997. They report similar evidence of long-run abnormal return as in the U.S., i.e., average excess return over three-year period after the repurchase announcements in Canada is about 7% per year. Dividing the sample into value and growth stocks, they find that, over three-year period following the announcements, average excess returns is 9.1% per year for value stocks and 3.3% per year for growth stocks. This evidence suggests that the market ignores most of the information conveyed through open market repurchase announcements.

McNally (2002) study the open market repurchases in Canada using the data from 1989 to 1998. He finds average abnormal return of 1.3% around the announcements. However, the average abnormal return over two years following the announcements is very large at 25% or 11.8% per annum, suggesting that the stock was undervalued at the time of announcements and that the market did not learn the full extent of undervaluation from the share repurchase announcements.

Underreaction hypothesis is further corroborated by Chan, Ikenberry, and Lee (2004) who evaluate cross-sectional differences in both the initial market reaction and longer-horizon performance using a comprehensive sample of over 5,000 repurchases announced in the U.S. between 1980 and 1996. They find that the initial market reaction is positive but not complete and the long-run return is positively significant. That is, the market receives negative information shocks in the form of negative earnings surprises before a share repurchase announcement. Over a four-year window following the announcement, earnings surprises tend to be positive and significant with the mean four-year abnormal buy-and-hold return of 23.56%. This evidence suggest that the initial market reaction is biased and incomplete.

Market underreaction is also observed in similar corporate events such as dividend changes. Grullon, Michaely, and Swaminathan (2002) find that the initial positive market reaction to a dividend increase can be explained by the subsequent decline in systematic risk. Over the next three years following dividend increase announcements, the dividend-increasing firms with the largest decline in systematic risk experience the largest price increases. This evidence suggests that the market initially underreacts to dividend increase announcements.

Kadiyala and Rau (2004) study four different corporate events (seasoned equity offerings, stock-financed acquisitions, share repurchases, and cash-financed acquisitions) in order to distinguish two behavioural hypotheses: underreaction and overreaction. Consistent with underreaction hypothesis, their evidence shows that the long-run abnormal returns reflect investors' tendency to underreact, first to short-term information available prior to the event and then to information conveyed by the event itself. Nevertheless, there is no evidence that overreaction hypothesis can explain long-run abnormal returns to any of these four events.

From a theoretical perspective, Isagawa (2002) develop a signalling model explaining stock price behaviour associated with open-market share repurchase activities in an inefficient market. The model shows that, when the market is not completely efficient, stock price of a firm would be undervalued after share repurchase announcements. This is caused by the market misperception (noises) of the true value of the firm. In other words, the market underreacts to the information conveyed by managers via open market repurchase announcements. Consequently, the firm can earn capital gains from this market misperception by repurchasing its outstanding shares at bargain prices until the market misperception disappears. Capital gains that the firm earns from share repurchases constitute the positive long-run stock returns. Therefore, the firm has a strong incentive to actually repurchase shares even though a share repurchase announcement is not a firm commitment.

CHAPTER 3
Theoretical Models

This chapter presents two theoretical models related to corporate payout policy. The first model, developed in spirit of Isagawa (2000), presents a situation in which the managers of high-quality and low-quality firms decide whether to payout excess cash in the form of dividends or share repurchases, or, alternatively, to invest in a real project from which they can get private benefits. The model aims to demonstrate that a share repurchase may be used to signal undervaluation, to time the market, or to mitigate agency cost of free cash flows. The second model, developed from Fairchild and Zhang's (2005) work, is a catering model in which the managers of high-quality and low-quality firms decide whether to use free cash flows to pay dividends or repurchase shares in order to cater to investors' demand, or to invest in a real project from which they can take private benefits. This model shows that the manager's catering motive to pay dividends or repurchase shares can create adverse selection problem but, at the same time, can help mitigate overinvestment problem.

3.1 Signalling/Timing/FCF Model

3.1.1 Introduction

I first consider a situation in which the stock price is deviating from its fundamental value and the manager is deciding whether to return excess cash to investors in the form of dividends or share repurchases. The manager of an undervalued firm (firm *H*) can announce a share repurchase programme to signal the market that his firm's stock price is currently undervalued, whereas the manager of an overvalued firm (firm *L*) may attempt to mimic and thus send a false signal to the market. In this model, the manager's compensation is tied to both short-term and long-term firm's market values, and the manager's equity stake does increase if he decides to repurchase shares. I analyse the model in two versions: (1) the market reacts immediately and strongly to share repurchase announcements; and (2) the market underreacts to share repurchase announcements.

In the first version, the results show that repurchasing shares is firm *H*'s dominant strategy because firm *H* wants to signal to the market that it is undervalued while firm *L*'s decision depends on the relative magnitudes of a pooling gain (i.e., announcing a share repurchase programme) and a capital loss from buying back overvalued shares. Consequently, there exist a separating equilibrium in which firm *H* repurchases shares while firm *L* pays dividends and a pooling equilibrium in which both firms repurchase shares. However, firm *H* cannot obtain any gain from repurchasing shares because the stock price increases immediately to its fundamental value.

In the second version, under the assumption that the market underreacts to share repurchase announcements, the results indicate that repurchasing shares is a dominant strategy for firm *H* because it can always repurchase shares at a pooling price, which is lower than fundamental value, while firm *L* will not mimic because it cannot obtain any short-term benefit from sending a false signal to the market, and doing so will decrease its long-term firm value. Thus, there exists a unique separating equilibrium in which firm *H* repurchases shares while firm *L* pays dividends.

Subsequently, in spirit of Isagawa (2000), I develop a signalling model in which the manager considers whether to payout excess cash in the form of dividends or repurchases, or, alternatively, invest it in a new project. Isagawa (2000) develops a signalling model in which the manager chooses between open-market share repurchases and a real investment from which the manager receives private benefits. He then derives a separating equilibrium in which the manager with a high private benefit chooses to invest in a new project while the manager with a low private benefit chooses to repurchase shares. While Isagawa's (2000) model provides a key insight regarding the overinvestment problem, it appears to be incomplete in that: (1) it does not include a cash dividend, which is a primary means of corporate payout; (2) it considers only the case in which the managerial compensation is tied only to the firm's long-term fundamental value; and (3) it does not consider an increase in managerial equity stake after shares are repurchased.

Thus, my model includes both forms of corporate payout, dividends and share repurchases. It also considers the case in which the managerial compensation is tied to both the short-term firm value immediately after the manager announces his investment/payout policy and the long-term firm value after the return from investment is realised or the excess cash is returned to investors in the form of dividends or share repurchases. In addition, it considers an increase in managerial equity stake after shares are repurchased.

I focus on the case in which the return on investment for firm *H* is positive whereas the return on investment for firm *L* is negative. That is, firm *H* has a better prospect while firm *L* has a worse prospect. The model is then analysed in three possible cases: (1) the manager assigns equal weight to his short-term and long-term payoffs; (2) the manager maximises only his short-term payoff; and (3) the manager maximises only his long-term payoff.

As before, the model in analysed in two versions: (1) the market reacts immediately and strongly to share repurchase announcements; and (2) the market underreacts to share repurchase announcements. The model demonstrates that, regardless of the managerial weight parameter, paying dividends is a dominated strategy for firm *H*. In the first version, there exist three equilibria: (1) a pooling equilibrium in which both firms repurchase shares if the private benefit is too low for both firms; (2) a separating equilibrium in which firm *H* invests in a new project while firm *L* repurchases shares if the private benefit is large enough for firm *H* but too low for firm *L*; and (3) a pooling equilibrium in which both firms invest in the new project if the private benefit is sufficiently high for both firms. In the second version, there exist two equilibria: (1) a separating equilibrium in which firm *H* invests in a new project while firm *L* repurchases shares if the private benefit is large enough for firm *H* but too low for firm *L*; and (2) a pooling equilibrium in which both firms invest in the new project if the private benefit is sufficiently high for both firms. Note that, if the market underreacts to share repurchases, I do not obtain a pooling equilibrium in which both firms repurchase shares because firm *L* has no incentive to mimic firm *H*.

The model further demonstrates that, if the manager's objective is to maximise his short-term payoff, firm *L*'s manager has a strong incentive to make a false signal by announcing a share repurchase programme while firm *H*'s manager will undertake a positive NPV project if the private benefit is large enough but repurchase shares if the private benefit is too small (adverse selection problem). Thus, I obtain a pooling equilibrium in which both firms repurchase shares and a pooling equilibrium in which both firms invest in the new project. Conversely, if the manager's objective is to maximise his long-term payoff, firm *H*'s manager will choose to repurchase (undervalued) shares or invest in a positive NPV project from which he can also obtain private benefits, whereas firm *L*'s manager chooses to invest excess cash in an unprofitable project if the private benefit is sufficiently large (moral hazard problem) but chooses to repurchase shares if the private benefit is small. The model also shows that the higher the long-term managerial weight, the lower the private benefits the manager requires for undertaking the new project.

I further consider the case in which a share repurchase may be used by managers to mitigate overinvestment problem. Assuming that both firms have negative NPV projects, I derive a separating equilibrium in which firm *H* repurchases shares while firm *L* invests in the new project when the private benefit from investment is too low for both firms. The result that the firm with a low private benefit repurchases shares in order to commit not to take a negative NPV project is consistent with that in Isagawa (2000).

3.1.2 The Model: Dividends versus Share Repurchases

Consider a market consisting of two all-equity firms whose type $i \in \{H, L\}$, where H represents a high-quality type and L represents a low-quality type. A high-quality firm is characterised by better future prospects than a low quality firm. All participants are risk-neutral and the interest rate is zero.

At date 0, each firm has N shares outstanding, of which the manager has N_M shares, and the outsiders have N_S shares. Hence, $N = N_M + N_S$, and the managerial equity stake is $\alpha = \frac{N_M}{N}$. In addition, each firm i has present values of future cash flows Y_i, with $Y_H > Y_L$, and there is information asymmetry between managers and shareholders regarding these present values of future cash flows. At this date, the market cannot observe firm type and thus assigns an equal probability to each firm being type H or L.

At date 1, each firm has excess cash flow X and the manager of each firm simultaneously decides between two payout modes. Firstly, he can invest the cash flow at zero NPV in the financial market, using the proceeds to pay a dividend X at date 2. Secondly, each firm can use the cash flow to repurchase some shares.

At date 2, types are revealed and payouts occur.

I consider a signalling game in which I solve for the Bayesian equilibria. Hence, I must specify the manager $i's$ objective function, and the market's posterior beliefs upon observing the managers' date 1 decision. Under the dividend policy, the manager's equity stake remains α throughout both dates. The manager's equity stake in the firm does increase, however, if the manager repurchases (and destroys) shares. I define a post-repurchase managerial equity stake as β, where $\beta > \alpha$.

The managerial payoff function is defined as

$$\Pi_i = \alpha w_1 \hat{V}_1 + \beta w_2 V_2, \tag{M1}$$

where α represents the managers' (exogenously given) equity stake in the firm, $\hat{V}_1$ represents the date 1 market value of the firm (which is determined by the date 1 signal), and V_2 represents the date 2 fundamental value of the firm. Further, w_1 represents the weight that the manager assigns to the date 1 value of the firm, and w_2 represents the weight that the manager assigns to the date 2 value of the firm. If manager i decides to use cash flow X to repurchase shares (with the repurchased shares destroyed), he increases his equity stake to β.

3.1.2.1 Market Reacts Strongly to Share Repurchase Announcements

In order to solve the equilibrium, I need to specify the market's posterior beliefs once it observes the payout signals from both firms. In a Bayesian equilibrium, the firms' equilibrium strategies are consistent with these beliefs. Rasmusen (2001, pp.54-56) suggests a three-step procedure for checking a Nash equilibrium:

(1) Propose a strategy combination.
(2) See what beliefs the strategy combination generates when players updates their beliefs in responses to each others' moves.
(3) Check that, given those beliefs together with the strategies of the other player, each player is choosing a best response for himself.

(i) Market's Posterior Beliefs

The market's posterior beliefs once it observes the manager's payout policy $\{s_H, s_L\}$ at date 1 are defined as follows:

(1) If both firms use identical policy $\{D,D\}$ or $\{R,R\}$, the market cannot update its beliefs, and continues to assign equal probability to each firm being high or low-quality type.

(2) If the market observes $\{R, D\}$, it believes that the firms are $\{H, L\}$. That is, the market believes that the firm announcing a share repurchase programme is currently undervalued.

(ii) The Managerial Payoffs

Figure 3.1: Dividend and Repurchase Signalling Game
(Market Reacts Strongly to Share Repurchase Announcements)

H \ ***L***	D	R
D	(a), (b)	(c), (d)
R	(e), (f)	(g), (h)

The normal-form game for this case can be depicted in figure 3.1 above and the corresponding managerial payoffs are shown in following lemma 1.

Lemma 1: *The effects of payout policy on expected managerial payoffs are as follows:*

a) Both firms pay dividends

$$\Pi_H\{D,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(Y_H + X\right)\right] \quad (a)$$

$$\Pi_L\{D,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(Y_L + X\right)\right] \quad (b)$$

b) Firm H pays dividends while firm L repurchases shares

$$\Pi_H\{D,R\} = \alpha\left[w_1\left(Y_L + X\right) + w_2\left(Y_H + X\right)\right] \quad (c)$$

$$\Pi_L\{D,R\} = \alpha\left[w_1(Y_H + X) + w_2\left(\frac{Y_H + X}{Y_H}\right)Y_L \right] \quad (d)$$

c) *Firm H repurchases shares while firm L pays dividends*

$$\Pi_H\{R,D\} = \alpha\left[w_1(Y_H + X) + w_2(Y_H + X)\right] \quad (e)$$

$$\Pi_{ML}\{R,D\} = \alpha\left[w_1(Y_L + X) + w_2(Y_L + X)\right] \quad (f)$$

d) *Both firms repurchase shares*

$$\Pi_H\{R,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H \right] \quad (g)$$

$$\Pi_L\{R,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L \right] \quad (h)$$

Proof: See Appendix A

(iii) Equilibrium Analysis

Having obtained all the managerial payoffs, I can now solve the equilibrium strategies of both firms. I first consider the case in which the manager balances his short-term and long-term payoffs $(w_1 = w_2 = 1/2)$.

Proposition 1*: Repurchasing shares is a dominant strategy for firm H. Firm L will also choose to repurchase shares if* $\left(\frac{Y_H - Y_L}{2}\right) > X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$ *but choose to pay dividends if* $\left(\frac{Y_H - Y_L}{2}\right) < X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$. *Consequently, there exist a separating equilibrium in which firm H repurchases shares while firm L pays dividends and a pooling equilibrium in which both firms repurchase shares.*

Proof: See Appendix A.

It is obvious that firm *H* will always choose to repurchase shares because it receives capital gains from buying back undervalued shares. In addition, firm *H* can signal its type by repurchasing shares if firm L chooses to pay dividends. Firm L's payout decision depends on the relative magnitudes of a pooling gain $\left(\frac{Y_H - Y_L}{2}\right)$ at date 1 and a capital loss $\left[X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right)\right]$ at date 2 from buying back overvalued shares.

In separating equilibrium $\{R, D\}$, the market value of firm H increases to $Y_H + X$ while the market value of firm L decreases to $Y_L + X$ at date 1. The market values of both firms at date 2 are the same as those at date 1. In pooling equilibrium $\{R, R\}$, the market values of both firms at date 1 are $\left(\frac{Y_H + Y_L + 2X}{2}\right)$. At date 2, the market value of firm H increases to $\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H$ because firm H earns a capital gain from buying back undervalued shares at a pooling price at date 1, while the market value of firm L decreases to $\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L$ as a result of buying back overvalued shares at a pooling price at date 1.

Corollary 1: *If the manager's objective is to maximise his short-term payoff* $(w_1 = 1, w_2 = 0)$, *there exists a pooling equilibrium in which both firms repurchase shares. On the other hand, if the manager's objective is to maximise his long-term payoff* $(w_1 = 0, w_2 = 1)$, *there exists a separating equilibrium in which firm H repurchases shares while firm L pays dividends.*

Proof: It follows from proposition 1 that, regardless of the managerial weight parameter, firm H's manager will always choose to repurchase (undervalued) shares. To maximise his short-term payoff, firm L's manager will choose to repurchase shares because he receives a pooling gain $\left(\frac{Y_H - Y_L}{2}\right)$. To maximise his long-term payoff, however, firm L's manager will choose to pay dividends rather than repurchase (overvalued) shares, causing a capital loss $\left[X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right)\right]$ at date 2.

The effects of equilibrium strategies on firm values are the same as those in proposition 1. In pooling equilibrium $\{R, R\}$, the market values of both firms at date 1 are $\left(\frac{Y_H + Y_L + 2X}{2}\right)$. At date 2, the market value of firm H increases to $\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H$ because firm H earns a capital gain from buying back undervalued shares while the market value of firm L decreases to $\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L$ as a result of buying back overvalued shares. In separating equilibrium $\{R, D\}$, the market value of firm H increases to $Y_H + X$ while the market value of firm L decreases to $Y_L + X$ at date 1. The market values of both firms at date 2 are the same as those at date 1.

3.1.2.2 Market Underreacts to Share Repurchase Announcements

In this section, I present a case in which the market underreacts to share repurchase announcements. Specifically, the market does not update its beliefs regarding firm types once they observe one firm repurchases shares and the other pays dividends. Therefore, the manager of undervalued firm can make use of this market underreaction and earn capital gains by buying back outstanding shares at a bargain price. That is, the manager announces a share repurchase programme in order to time the market.

(i) Market's Posterior Beliefs

The market's posterior beliefs once it observes the manager's payout policy $\{s_H, s_L\}$ at date 1 are defined as follows:

(1) If both firms use identical policy $\{D, D\}$ or $\{R, R\}$, the market cannot update its beliefs, and continues to assign equal probability to each firm being high or low-quality type.

(2) If the market observes $\{R, D\}$ or $\{D, R\}$, the market does not update its beliefs and continues to assign equal probability to each firm being high or low-quality type.

(ii) Managerial Payoffs

Figure 3.2: Dividend and Repurchase Signalling Game
(Market Underreacts to Share Repurchase Announcements)

H \ ***L***	D	R
D	(i), (j)	(k), (l)
R	(m), (n)	(o), (p)

The normal-form game for this case can be depicted in figure 3.2 above and the corresponding managerial payoffs are shown in following lemma 2.

Lemma 2*: If the market underreacts to share repurchase announcement, the expected managerial payoffs are as follows:*

a) Both firms pay dividends

$$\Pi_H\{D,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2(Y_H + X)\right] \qquad (i)$$

$$\Pi_L\{D,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2(Y_L + X)\right] \qquad (j)$$

b) Firm H pays dividends while firm L repurchases shares

$$\Pi_H\{D,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2(Y_H + X)\right] \qquad (k)$$

$$\Pi_L\{D,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L\right] \qquad (l)$$

c) Firm H repurchases share while firm L pays dividends

$$\Pi_H\{R,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H\right] \qquad (m)$$

$$\Pi_L\{R,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2(Y_L + X)\right] \qquad (n)$$

d) Both firms repurchase shares

$$\Pi_H\{R,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H\right] \qquad (o)$$

$$\Pi_L\{R,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L\right] \qquad (p)$$

Proof: See Appendix A

Proposition 2*: Repurchasing shares is a dominant strategy for firm H but a dominated strategy for firm L. Hence, there exists a unique separating equilibrium in which firm H repurchase shares while firm L pays dividends.*

Proof: See Appendix A

If the market does not update its beliefs upon observing separating strategy $\{R, D\}$ or $\{D, R\}$, firm *H*'s manager can repurchase shares at the pooling price, which is lower than its fundamental price, while firm *L*'s manager will not repurchase shares because he cannot obtain any pooling gain at date 1 and doing so will decrease his firm value at date 2. Note that the separating equilibrium in proposition 2 is the same as that in corollary 1 when the manager maximises his long-term payoff $\left(w_1 = 0, w_2 = 1\right)$.

In separating equilibrium $\left\{R, D\right\}$, the market values of both firms at date 1 are still the same as those at date 0 $\left(\dfrac{Y_H + Y_L + 2X}{2}\right)$ because of the market underreaction to share repurchase announcements. At date 2, the market value of firm *H* increases to $\left(\dfrac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H$ because firm *H* earns a capital gain from buying back undervalued shares $X\left(\dfrac{Y_H - Y_L}{Y_H + Y_L}\right)$, whereas the market value of firm *L* decreases to its true value $Y_L + X$.

3.1.3 The Model: Dividends, Share Repurchases, and Real Investment

The outline of the model is essentially the same as in section 3.1.2 except that the manager can choose to invest the cash flow *X* in a new project at date 1 and doing so gives him a private benefit $B > 0$ between date 1 and date 2. The sequence of the model is summarised again here as follows:

At date 0, each firm has N shares outstanding, of which the manager has N_M shares, and the outsiders have N_S shares. Hence, $N = N_M + N_S$. In addition, each firm i has present value of future cash flows Y_i, with $Y_H > Y_L$. At this date, the market cannot observe firm type, and thus assigns an equal probability to each firm being type H or L.

At date 1, each firm has excess cash flow X. The manager of each firm simultaneously decides payout/investment policies. Firstly, each type can invest cash flow X at zero NPV in the financial market, using the proceeds to pay a dividend X at date 2. Secondly, each firm can use cash flow X to repurchase some shares. Thirdly, each firm can invest cash flow X in a new project. This provides an income at date 2 of $X(1+r_i)$, where $r_H > 0$ and $r_L < 0$ (that is, type H firm has a positive NPV project available, while type L firm has a negative NPV project available). I take as given that $r_H + r_L = 0$; that is, the positive and negative NPV projects exactly balance each other, and, on average, the projects have zero NPV. (One will observe that this assumption greatly simplifies the analysis). Further, it is assumed that if the manager decides to invest in a new project, he will receive a private benefit $(B > 0)$ between date 1 and date 2.

At date 2, types are revealed, the cash flow from the project is realised, and payouts occur.

At date 3, the manager receives private benefits if he decided to invest in the new project at date 1.

The managerial payoff function in (M1) is amended as

$$\Pi_i = \alpha w_1 \hat{V}_1 + \beta w_2 V_2 + w_3 B, \tag{M2}$$

where $w_1 + w_2 + w_3 = 1$, $B > 0$ is the private benefit received at date 3 if the manager chooses to invest in the new project and $B = 0$ if he chooses to pay dividends or repurchase shares; w_3 is the weight the manager assigns to the date-3 private benefit. All the other parameters are the same as those in (M1).

3.1.3.1 Market Reacts Strongly to Share Repurchase Announcements

(i) Market's Posterior Beliefs

Recall that, in order to solve the firms' equilibrium strategies, one needs to specify the market's posterior beliefs and, in Bayesian equilibrium, the equilibrium outcomes are consistent with these beliefs. The market's posterior beliefs once it observes the manager's payout/investment policies $\{s_H, s_L\}$ are specified as follows:

(1) If both firms use identical policy $\{D, D\}$, $\{R, R\}$, or $\{I, I\}$, the market cannot update its beliefs, and continues to assign equal probability to each firm being high or low-quality type.

(2) If the market observes $\{R, D\}$, it believes that the firms are $\{H, L\}$.

(3) If the market observes $\{R, I\}$, it believes that the firms are $\{H, L\}$.

(4) If the market observes $\{D, I\}$, it believes that the firms are $\{L, H\}$.

(ii) Managerial Payoffs

The normal-form game for this case can be depicted in figure 3.3 and the corresponding managerial payoffs are shown in following lemma 3.

Figure 3.3: Payout/Investment Signalling Game

(Market Reacts Strongly to Share Repurchase Announcements)

H \ ***L***	*D*	*R*	*I*
D	(1), (2)	(3), (4)	(5), (6)
R	(7), (8)	(9), (10)	(11), (12)
I	(13), (14)	(15), (16)	(17), (18)

Lemma 3*: The effects of payout/investment policies on expected managerial payoffs are as follows:*

a) *Both firms pay dividends*

$$\Pi_H\{D,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(Y_H + X\right)\right] \quad (1)$$

$$\Pi_L\{D,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(Y_L + X\right)\right] \quad (2)$$

b) *Firm H pays dividends while firm L repurchases shares*

$$\Pi_H\{D,R\} = \alpha\left[w_1\left(Y_L + X\right) + w_2\left(Y_H + X\right)\right] \quad (3)$$

$$\Pi_L\{D,R\} = \alpha\left[w_1(Y_H + X) + w_2\left(\frac{Y_H + X}{Y_H}\right)Y_L\right] \quad (4)$$

c) *Firm H pays dividends while firm L invests in the new project*

$$\Pi_H\{D,I\} = \alpha\left[w_1\left(Y_L + X\right) + w_2\left(Y_H + X\right)\right] \quad (5)$$

$$\Pi_L\{D,I\} = \alpha\left[w_1\left(Y_H + X\left(1 + r_H\right)\right) + w_2\left(Y_L + X\left(1 + r_L\right)\right)\right] + w_3 B \quad (6)$$

d) *Firm H repurchases shares while firm L pays dividends*

$$\prod_H \{R,D\} = \alpha\left[w_1(Y_H + X) + w_2(Y_H + X)\right] \tag{7}$$

$$\prod_L \{R,D\} = \alpha\left[w_1(Y_L + X) + w_2(Y_L + X)\right] \tag{8}$$

e) *Both firms repurchases shares*

$$\prod_H \{R,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H\right] \tag{9}$$

$$\prod_L \{R,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L\right] \tag{10}$$

f) *Firm H repurchases shares while firm L invests in the new project*

$$\prod_H \{R,I\} = \alpha\left[w_1(Y_H + X) + w_2(Y_H + X)\right] \tag{11}$$

$$\prod_L \{R,I\} = \alpha\left[w_1(Y_L + X(1 + r_L)) + w_2(Y_L + X(1 + r_L))\right] + w_3 B \tag{12}$$

g) *Firm H invests in the new project while firm L pays dividends*

$$\prod_H \{I,D\} = \alpha\left[w_1(Y_H + X(1 + r_H)) + w_2(Y_H + X(1 + r_H))\right] + w_3 B \tag{13}$$

$$\prod_L \{I,D\} = \alpha\left[w_1(Y_L + X) + w_2(Y_L + X)\right] \tag{14}$$

h) *Firm H invests in the new project while firm L repurchases shares*

$$\prod_H \{I,R\} = \alpha\left[w_1(Y_L + X(1 + r_L)) + w_2(Y_H + X(1 + r_H))\right] + w_3 B \tag{15}$$

$$\prod_L \{I,R\} = \alpha\left[w_1(Y_H + X) + w_2\left(\frac{Y_H + X}{Y_H}\right)Y_L\right] \tag{16}$$

i) *Both firms invest in the new project*

$$\prod_H \{I,I\} = \alpha\left[\left(w_1\left(\frac{Y_H + Y_L + 2X}{2}\right)\right) + w_2(Y_H + X(1 + r_H))\right] + w_3 B \tag{17}$$

$$\prod_L \{I,I\} = \alpha\left[\left(w_1\left(\frac{Y_H + Y_L + 2X}{2}\right)\right) + w_2(Y_L + X(1 + r_L))\right] + w_3 B \tag{18}$$

Proof: See Appendix A.

(iii) Equilibrium Analysis

To make analysis tractable, I assume the following assumption[6]

$$w_2 X r_H > w_1\left(\frac{Y_H - Y_L}{2}\right) > w_2 X\left(\frac{Y_H - Y_L}{Y_H}\right), \tag{a1}$$

where $w_1 > 0$ and $w_2 > 0$. Assumption (a1) ensures that firm *H* will invest in the new project if firm *L* invests in the new project and that firm *L* has an incentive to mimic if firm *H* repurchases shares.

I first consider each firm's best responses when managers balance weight parameters at three dates $(w_1 = w_2 = w_3 = 1/3)$.

Lemma 4: *Paying dividends is a dominated strategy for firm H. Firm H's best responses to firm L's strategies are as follows:*

a) *If firm L pays dividends, firm H will choose to invest in the new project.*
b) *If firm L repurchases shares, firm H will choose to repurchase shares if* $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$ *but choose to invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$.
c) *If firm L invests in the new project, firm H will also invest in the new project.*

Proof: See Appendix A.

[6]Without this assumption, the permutations significantly increase, thus making analysis much more complex.

It is obvious that firm H's manager will not choose to pay dividends because he can get a capital gain from repurchasing shares at a bargain price or a capital gain from undertaking a positive NPV project from which he can also take private benefits. If firm L pays dividends or invests in a new project and firm H chooses to separate by announcing a share repurchase programme, the stock price of firm H will increase immediately to its fundamental value so that firm H will not obtain any gain from buying back shares.[7] Hence, given assumption (a1), firm H will respond by undertaking a new project if firm L pays dividends or invests in a new project as shown in lemma 4a) and lemma 4c).

Lemma 4b) indicates that, given that firm L repurchases shares, firm H will respond by taking a positive NPV project rather than repurchase shares if the private benefit exceeds the information asymmetry cost $\left(\frac{Y_H - Y_L}{2}\right)$ and the opportunity cost of not repurchasing undervalued shares $X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$.

Lemma 5: *Firm L's best responses to firm H's strategies are as follows:*

a) *If firm H repurchases shares, firm L will repurchase shares if* $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$ *but invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$.

[7] This is pointed out by Isagawa (2002) that, in an efficient market, it is difficult to explain why a firm would choose to repurchase its shares after the stock price goes up in response to a share repurchase announcement.

b) *If firm H invests in the new project, firm L will repurchase shares if* $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$ *but invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.

Proof: See Appendix A.

Intuitively, lemma 5a) indicates that, if firm *H* repurchases shares, firm *L* will choose to undertake an unprofitable project rather than repurchase shares if the private benefit nets the capital loss from investment is higher than the pooling gain (if it otherwise chooses to repurchase shares) nets the loss from repurchasing overvalued shares at a pooling price.

Lemma 5b) indicates that, if firm *H* invests in a new project, firm *L* will choose to invest in a negative NPV project rather than repurchase shares if the private benefit nets the capital loss from investment is higher than the gain from sending a false signal to the market (i.e., announcing a share repurchase programme) nets the capital loss from repurchasing overvalued shares at firm *H*'s stock price.

Proposition 3: *If the manager balances his payoffs* $(w_1 = w_2 = w_3 = 1/3)$*, there exist following equilibria:*

a) *A pooling equilibrium in which both firms repurchase shares if*

$$B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right] \text{ and } B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right].$$

b) *A separating equilibrium in which firm H invests in the new project while firm L repurchase shares if*

$$\alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right] \leq B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right].$$

c) *A pooling equilibrium in which both firms invest in the new project*

$$if\, B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right].$$

Proof: Proof comes directly from lemma 4 and lemma 5.

In this proposition, I obtain a separating equilibrium in which firm *H* invests in a new project while firm *L* repurchases shares if (1) the private benefit is large enough for firm *H* to offset both the information asymmetry cost and the (opportunity) cost of not buying back undervalued shares; and (2) the private benefit net the capital loss of undertaking a negative NPV project is lower than the gain from sending a false signal to the market (i.e., announcing a share repurchase programme) net the loss from buying back overvalued shares for firm *L*.

The effects of separating equilibrium $\{I, R\}$ on firm values are as follows. At date 1, the market value of firm *H* decreases to $Y_L + X(1 + r_L)$ while the market value of firm *L* increases to $Y_H + X$. At date 2, as all the information is revealed, the market value of firm *H* increases to $Y_H + X(1 + r_H)$ because of a capital gain from investing in a positive NPV project while the market value of firm *L* drops to $\left(\frac{Y_H + X}{Y_H}\right)Y_L$ as a result of buying back overvalued shares at firm *H*'s stock price at date 1.

Corollary 2: *If the manager assigns more weight to short-term payoff* $(e.g., w_1 = 0.6, w_2 = 0.3, w_3 = 0.1)$*, there exist following equilibria:*

a) *A pooling equilibrium in which both firms repurchase shares if*

$$B < 3\alpha\left[(Y_H - Y_L) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right] and\, B < 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right].$$

b) *A separating equilibrium in which firm H invests in the new project while firm L repurchase shares if*

$$3\alpha\left[(Y_H - Y_L) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right] \le B < 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right].$$

c) *A pooling equilibrium in which both firms invest in the new project*

$$\text{if } B \ge 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right].$$

Proof: See Appendix A.

When the manager places more weight on short-term payoff, I obtain the same equilibria as those in the case where the manager balances his payoffs at three dates. Note that, for a pooling equilibrium in which both firms invest in the new project to be achieved, the manager requires higher private benefits as he places higher weight on short-term payoff. The effects of equilibria on firm values are the same as those in the case where the manager balances his payoffs.

Corollary 3: *If the manager assigns more weight to long-term payoff* $(e.g., w_1 = 0.1, w_2 = 0.3, w_3 = 0.6)$*, there exist following equilibria:*

a) *A pooling equilibrium in which both firms repurchase shares if*

$$B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right] \text{ and}$$

$$B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 4Xr_L\right].$$

b) *A separating equilibrium in which firm H invests in the new project while firm L repurchase shares if*

$$\frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right] \le B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$$

c) *A pooling equilibrium in which both firms invest in the new project*

$$if B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right].$$

Proof: See Appendix A.

When the manager places more weight on long-term payoff, the same equilibria as those in the case where the manager balances his payoffs are obtained. Note that, for a pooling equilibrium in which both firms invest in the new project to be achieved, the manager requires lower private benefits as he places higher weight on long-term payoff. The effects of equilibria on firm values are the same as those in the case where the manager balances his payoffs.

3.1.3.2 Market Underreacts to Share Repurchase Announcements

In this version, I consider the case in which firm *H*'s manager attempts to signal that his firm is currently undervalued by announcing a share repurchase programme but investors underreact to share repurchase announcements. That is, investors fail to recognise that managers are buying back shares in order to time the market.

(i) Market's Posterior Beliefs

The market's posterior beliefs once it observes the manager's payout/investment policies $\{s_H, s_L\}$ at date 1 are the same as in prior section except that investors do not update their beliefs once they observe the signal $\{R, D\}$ or $\{D, R\}$, but continue to assign equal probability to each firm being high or low-quality type.

(ii) Managerial Payoffs

Figure 3.4: Payout/Investment Signalling Game
(Market Underreacts to Share Repurchase Announcements)

H \ *L*	*D*	*R*	*I*
D	(19), (20)	(21), (22)	(23), (24)
R	(25), (26)	(27), (28)	(29), (30)
I	(31), (32)	(33), (34)	(35), (36)

The normal-form game for this case can be illustrated in figure 3.4 above and the corresponding managerial payoffs are shown below.

a) Both firms pay dividends

$$\Pi_H\{D,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(Y_H + X\right)\right] \tag{19}$$

$$\Pi_L\{D,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(Y_L + X\right)\right] \tag{20}$$

b) Firm *H* pays dividends while firm *L* repurchases shares

$$\Pi_H\{D,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(Y_H + X\right)\right] \tag{21}$$

$$\Pi_L\{D,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L\right] \tag{22}$$

c) Firm *H* pays dividends while firm *L* invests in the new project

$$\Pi_H\{D,I\} = \alpha\left[w_1\left(Y_L + X\right) + w_2\left(Y_H + X\right)\right] \tag{23}$$

$$\Pi_L\{D,I\} = \alpha\left[w_1\left(Y_H + X\left(1+r_H\right)\right) + w_2\left(Y_L + X\left(1+r_L\right)\right)\right] + w_3 B \tag{24}$$

d) Firm *H* repurchase shares while firm *L* pays dividends

$$\Pi_H\{R,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H\right] \tag{25}$$

$$\Pi_L\{R,D\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(Y_L + X\right)\right] \tag{26}$$

e) Both firms repurchase shares

$$\Pi_H\{R,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H\right] \tag{27}$$

$$\Pi_L\{R,R\} = \alpha\left[w_1\left(\frac{Y_H + Y_L + 2X}{2}\right) + w_2\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L\right] \tag{28}$$

f) Firm *H* repurchases shares while firm *L* invests in the new project

$$\Pi_H\{R,I\} = \alpha\left[w_1\left(Y_H + X\right) + w_2\left(Y_H + X\right)\right] \tag{29}$$

$$\Pi_L\{R,I\} = \alpha\left[w_1\left(Y_L + X\left(1+r_L\right)\right) + w_2\left(Y_L + X\left(1+r_L\right)\right)\right] + w_3 B \tag{30}$$

g) Firm *H* invests in the new project while firm *L* pays dividends

$$\Pi_H\{I,D\} = \alpha\left[w_1\left(Y_H + X\left(1+r_H\right)\right) + w_2\left(Y_H + X\left(1+r_H\right)\right)\right] + w_3 B \tag{31}$$

$$\Pi_L\{I,D\} = \alpha\left[w_1\left(Y_L + X\right) + w_2\left(Y_L + X\right)\right] \tag{32}$$

h) Firm *H* invests in the new project while firm *L* repurchases shares

$$\Pi_H\{I,R\} = \alpha\left[w_1\left(Y_L + X\left(1+r_L\right)\right) + w_2\left(Y_H + X\left(1+r_H\right)\right)\right] + w_3 B \tag{33}$$

$$\Pi_L\{I,R\} = \alpha\left[w_1(Y_H + X) + w_2\left(\frac{Y_H + X}{Y_H}\right)Y_L\right] \tag{34}$$

i) Both firms invest in the new project

$$\Pi_H\{I,I\} = \alpha\left[\left(w_1\left(\frac{Y_H + Y_L + 2X}{2}\right)\right) + w_2\left(Y_H + X\left(1+r_H\right)\right)\right] + w_3 B \tag{35}$$

$$\Pi_L\{I,I\} = \alpha\left[\left(w_1\left(\frac{Y_H + Y_L + 2X}{2}\right)\right) + w_2\left(Y_L + X\left(1+r_L\right)\right)\right] + w_3 B \tag{36}$$

(iii) Equilibrium Analysis

Lemma 6: *Paying dividends is a dominated strategy for firm H. Firm H's best responses to firm L's strategies are as follows:*

a) *If firm L pays dividends, firm H will choose to invest in the new project.*
b) *If firm L repurchases shares, firm H will choose to repurchase shares if* $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$ *but choose to invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$.
c) *If firm L invests in the new project, firm H will choose to invest in the new project.*

Proof: See Appendix A.

Note that lemma 6 is the same as lemma 4. That is, firm *H*' best responses to firm *L*'s strategies under the case of inefficient market are not different from those under the case of efficient market.

Lemma 7: *Firm L's best responses to firm H's strategies are as follows:*

(a) If firm H repurchases shares, firm L will choose to pay dividends if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - 2Xr_L\right]$ *but choose to invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - 2Xr_L\right]$.

(b) If firm H invests in the new project, firm L will choose to repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$ *but choose to invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.

Proof: See Appendix A.

Lemma 7a) demonstrates that, given that firm *H* repurchases shares, firm *L* will not mimic because the market underreacts to share repurchase announcements. Its better choice is either to invest cash flow in financial market at zero NPV at date 1 and pay dividends at date 2 or to invest cash flow in the new project if the private benefit net the capital loss from investment is higher than the benefit from announcing a dividend payment.[8] Note that lemma 7b) is the same as lemma 5b).

Proposition 4: *If the manager balances his payoffs* $(w_1 = w_2 = w_3 = 1/3)$*, there exist following equilibria:*

a) A separating equilibrium in which firm H invests in the new project while firm L repurchases shares if $\alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right] \leq B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.

b) A pooling equilibrium in which both firms invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.

Proof: Proof comes directly from lemma 6 and lemma 7.

[8] Recall that the market does not update its beliefs regarding firm types once it observes one firm pays dividends while the other repurchases shares under the case of inefficient market.

If the market underreacts to share repurchase announcements, firm L has no incentive to make a false signal because it cannot receive any benefit from doing so. Note that proposition 4a) is the same as proposition 3b) and proposition 4b) is the same as proposition 3c). However, in inefficient market, I do not obtain a pooling equilibrium in which both firms repurchase shares as in proposition 3a).

In separating equilibrium $\{I,R\}$, the market value of firm H decreases to $Y_L + X(1+r_L)$ while the market value of firm L increases to $Y_H + X$ at date 1. At date 2, the market value of firm H increases to $Y_H + X(1+r_H)$ because of a capital gain from investing in a positive NPV project while the market value of firm L drops to $\left(\frac{Y_H + X}{Y_H}\right)Y_L$ as a result of buying back overvalued shares at firm H's stock price at date 1. In pooling equilibrium $\{I,I\}$, the market values of both firms at date 1 are $\left(\frac{Y_H + Y_L + 2X}{2}\right)$. At date 2, the market value of firm H increases to $Y_H + X(1+r_H)$ while the market value of firm L decreases to $Y_L + X(1+r_L)$.

Corollary 4: *If the manager assigns more weight to short-term payoff* $(e.g., w_1 = 0.6, w_2 = 0.3, w_3 = 0.1)$*, there exists a pooling equilibrium in which both firms invest in the new project if* $B \geq 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.

Proof: See Appendix A.

If the managers focuses on taking short-term benefits but the market underreacts to share repurchases, firm H will not obtain any positive market reaction by repurchasing shares while firm L will not choose to repurchase shares because it receives no benefit from sending a false signal to the market. Thus, I obtain a pooling equilibrium in which both firms choose to invest in a new project if the private benefit is sufficiently high. Note that, for this pooling equilibrium $\{I,I\}$ to be achieved, the manager requires higher private benefits as he places more weight on short-term payoff. In pooling equilibrium $\{I, I\}$, the market values of both firms at date 1 are $\left(\frac{Y_H + Y_L + 2X}{2}\right)$. At date 2, the market value of firm H increases to $Y_H + X(1 + r_H)$ while the market value of firm L decreases to $Y_L + X(1 + r_L)$.

Corollary 5: *If the manager assigns more weight to long--term payoff* $(e.g., w_1 = 0.1, w_2 = 0.3, w_3 = 0.6)$*, there exist following equilibria:*

a) A separating equilibrium in which firm H invests in the new project while firm L repurchases shares if

$$\frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right] \leq B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$$

b) A pooling equilibrium in which both firms invest in the new project

$$if B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right].$$

Proof: See Appendix A.

When the manager places more weight on long-term payoff, I obtain the same equilibria as in the case where the manager balances his payoffs. Note that, for a pooling equilibrium in which both firms invest in the new project to be achieved, the manager requires lower private benefits as he places more weight on long-term payoff. The effects of equilibria on firm values are the same as those in the case where the manager balances his payoffs.

3.1.4 Share Repurchase is used to Mitigate Overinvestment Problem

In this section, I consider the case in which a share repurchase may be used to mitigate the agency cost of free cash flows as in Isagawa (2000). Accordingly, it is assumed that the returns from investment are negative for both firms and that firm *H* has a more negative NPV project than firm $L\left(i.e., r_H < r_L < 0\right)$.
To make analysis tractable, I make the following assumption

$$-\alpha X r_L < w_3 B < -\alpha X r_H \,, \tag{a2}$$

where $w_3 > 0$. Assumption (a2) indicates that the private benefit cannot offset the loss from investment for firm *H* but can offset the loss from investment for firm *L*.

Re-analysing the managerial payoffs in lemma 3, I derive the following outcomes.

Lemma 8: *Paying dividends is a dominated strategy for firm H. Firm H's best responses to firm L's strategies are as follows:*

a) *If firm L pays dividends, firm H will choose to repurchase shares.*
b) *If firm L repurchases shares, firm H will choose to invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_H - Xr_L\right]$, *but choose to repurchase* shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_H - Xr_L\right]$.
c) *If firm L invests in the new project, firm H will invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - Xr_H\right]$ *but repurchase shares if* $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - Xr_H\right]$.

Proof: See Appendix A.

Lemma 8a) show that, given that firm L pays dividends, firm H will choose to repurchase shares rather than invest in the new project because the private benefit cannot offset the loss from undertaking a negative NPV project (assumption (a3)).

Lemma 8b) indicates that, given that firm L repurchases shares, firm H will choose to invest in a NPV project (moral hazard problem) rather than repurchase shares if the private benefit exceeds the information asymmetry cost $\left[\left(\frac{Y_H - Y_L}{2}\right) - Xr_L\right]$ at date 1 and the opportunity cost of not repurchasing undervalued shares and the loss from project investment $\left[X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_H\right]$ at date 2.

lemma 8c) show that, given that firm L invests in the new project, firm H will choose to repurchase shares rather than invest in the new project if the private benefit net the loss from undertaking a negative NPV project is lower than the gain from announcing a share repurchase programme.

Lemma 9: *Firm L's best responses to firm H's strategies are as follows:*

a) *If firm H repurchases shares, firm L will choose to invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$, *but choose to repurchase* shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$.

b) *If firm H invests in the new project, firm L will invest in the new project if* $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$ *but choose to repurchase shares if* $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.

Proof: See Appendix A.

Proposition 5: *If the manager balances his payoffs* $(w_1 = w_2 = w_3 = 1/3)$*, there exist following equilibria:*

a) A pooling equilibrium in which both firms repurchase shares if

$$B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$$

b) *A separating equilibrium in which firm H repurchases shares while firm L invests in the new project if*

$$\alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right] \le B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - Xr_H\right]$$

c) A pooling equilibrium in which both firms invest in the new project if

$$B \ge \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - Xr_H\right]$$

Proof: Proof comes directly from lemma 8 and lemma 9.

Note that, in proposition 5, there is a separating equilibrium in which firm *H* chooses to repurchase shares while firm *L* invests in the new project. The result that an undervalued firm repurchases shares in order to commit not to take a negative NPV project (i.e., a share repurchase helps mitigate agency cost of free cash flows) is consistent with Isagawa (2000). In this separating equilibrium $\{R, I\}$, the market value of firm *H* increases to its fundamental value $Y_H + X$ while the market value of firm *L* decreases to $Y_L + X(1 + r_L)$ at date 1, and, the market values of both firms at date 2 are the same as those at date 1.

Corollary 6: *If the manager assigns more weight to short-term payoff* $(e.g., w_1 = 0.6, w_2 = 0.3, w_3 = 0.1)$*, there exist following equilibria:*

a) A pooling equilibrium in which both firms repurchase shares if

$$B < 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$$

b) A pooling equilibrium in which both firms invest in the new project if

$$B \geq 3\alpha\left[\left(Y_H - Y_L\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$$

Proof: See Appendix A.

When the manager focuses on taking short-term benefits, both firms will announce a share repurchase programme in order to increase their short-term stock prices. Thus, there exists a pooling equilibrium in which both firms repurchase shares. However, if the private benefit is sufficiently high, both firms will undertake negative NPV projects. For a pooling equilibrium in which both firms invest in the new project to be achieved, the manager requires higher private benefits as he places more weight on short-term payoff.

In pooling equilibrium $\{R, R\}$, the market values of both firms at date 1 are $\left(\frac{Y_H + Y_L + 2X}{2}\right)$. At date 2, the market value of firm *H* increases to $\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H$ while the market value of firm *L* decreases to $\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L$.

In pooling equilibrium $\{I, I\}$, the market values of both firms at date 1 are $\left(\frac{Y_H + Y_L + 2X}{2}\right)$. At date 2, the market value of firm *H* decreases to $Y_H + X\left(1 + r_H\right)$ while the market value of firm *L* decreases to $Y_L + X\left(1 + r_L\right)$.

Corollary 7: *If the manager assigns more weight to long-term payoff* $\left(e.g., w_1 = 0.1, w_2 = 0.3, w_3 = 0.6\right)$, *there exist following equilibria:*

a) *A pooling equilibrium in which both firms repurchase shares if* $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_H\right]$ *and*

$$B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 4Xr_L\right]$$

b) *A separating equilibrium in which firm H invests in the new project while firm L repurchases shares if*

$$\frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_H\right] \le B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$$

c) *A separating equilibrium in which firm H repurchases shares while firm L invests in the new project if* $B \ge \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 4Xr_L\right]$

Proof: See Appendix A.

Both firms will not choose to invest in negative NPV projects unless the private benefit exceeds the benefit from announcing a share repurchase programme and the loss from investment. There is no pooling equilibrium in which both firms invest in the new project under this case. The manager requires lower private benefits for undertaking the new project as he places higher weight on the long-term payoff.

In pooling equilibrium $\{R, R\}$, the market values of both firms at date 1 are $\left(\frac{Y_H + Y_L + 2X}{2}\right)$. At date 2, the market value of firm *H* increases to $\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_H$ while the market value of firm *L* decreases to $\left(\frac{Y_H + Y_L + 2X}{Y_H + Y_L}\right)Y_L$.
In separating equilibrium $\{I, R\}$, the market value of firm *H* decreases to $Y_L + X(1 + r_L)$ while the market value of firm *L* increases to $Y_H + X$ at date 1. At date 2, the market value of firm *H* decreases to $Y_H + X(1 + r_H)$ while the market

value of firm L drops to $\left(\frac{Y_H + X}{Y_H}\right)Y_L$ as a result of buying back overvalued shares. In separating equilibrium $\{R, I\}$, the market value of firm H increases to its fundamental value $Y_H + X$ while the market value of firm L decreases to $Y_L + X(1 + r_L)$ at date 1, and the market values of both firms at date 2 are the same as those at date 1.

3.1.5 Summary of Equilibrium Strategies

The equilibrium strategies, the effects on firm value, and the intuitions behind the results of this model are summarised in Table 3.1.

Table 3.1 Summary of Equilibrium Strategies (Model 1)

	Equilibrium	Effects on Firm Value (H, L)		Intuition
		$V_1 - V_0$	$V_2 - V_1$	
Case 1. Dividend vs. Repurchase (efficient market)				
• $w_1 = w_2 = 1/2$	{R, D} {R, R}	(+ , -) (0 , 0)	(0 , 0) (+ , -)	Firm *H* wants to signal its type while firm *L* weighs the pooling gain at date 1 and the loss from buying back overvalued shares at date 2. In efficient market, firm *H* cannot obtain any gains from buying back shares because stock price increases immediately to fundamental value.
• $w_1 = 1, w_2 = 0$	{R, R}	(0 , 0)	(+ , -)	Firm *H* wants to signal its true value but firm *L* mimics to obtain pooling benefit. Firm *H* can repurchase undervalued shares while firm *L* experiences a loss from buying back overvalued shares.
• $w_1 = 0, w_2 = 1$	{R, D}	(+ , -)	(0 , 0)	Firm *H* can repurchase undervalued shares to increase long-term firm value. Firm *L* does not mimic since it has overvalued shares.
Case 2. Dividend vs. Repurchase (market underreaction to share repurchases)				
• $w_1 = w_2 = 1/2$	{R, D}	(0 , 0)	(+ , -)	Firm *H* can repurchase undervalued shares because of market underreaction to share repurchase announcements while firm *L* receives no benefit from mimicking.
• $w_1 = 1, w_2 = 0$	{D, D} {D, R} {R, D} {R, R}	(0 , 0) (0 , 0) (0 , 0) (0 , 0)	(+ , -) (+ , -) (+ , -) (+ , -)	There exist multiple equilibria since the market does not update its beliefs at date 1 once observing {R, D} or {D, R}.
• $w_1 = 0, w_2 = 1$	{R, D}	(0 , 0)	(+ , -)	Firm *H* can repurchase undervalued shares because of market underreaction to share repurchase announcements while firm *L* does not want to repurchase overvalued shares.

Table 3.1 Summary of Equilibrium Strategies (Model 1) (Continued)

	Equilibrium	Effects on Firm Value (*H*, *L*)		Intuition
		$V_1 - V_0$	$V_2 - V_1$	
Case 3. Dividend/Repurchase/Investment (efficient market)				
• $w_1 = w_2 = w_3 = 1/3$	{R, R} {I, R} {I, I}	(0 , 0) (- , +) (0 , 0)	(+ , -) (+ , -) (+ , -)	Firm *H* invests in the new project if the private benefit is higher than the cost of information asymmetry and the gain from repurchasing shares while firm *L* repurchases shares if the private benefit is lower than the gain from sending a false signal and the loss from repurchasing shares.
• $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$	{R, R} {I, R} {I, I}	(0 , 0) (- , +) (0 , 0)	(+ , -) (+ , -) (+ , -)	Both firms are more likely to repurchase shares. The manager requires higher private benefit in order to invest in the new project as he places higher weight on short-term payoff.
• $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$	{R, R} {I, R} {I, I}	(0 , 0) (- , +) (0 , 0)	(+ , -) (+ , -) (+ , -)	Both firms are more likely to invest in the new projects. The manager requires lower private benefit in order to invest in the new project as he places higher weight on long-term payoff.

Table 3.1 Summary of Equilibrium Strategies (Model 1) (Continued)

	Equilibrium	Effects on Firm Value (*H*, *L*)		Intuition
		$V_1 - V_0$	$V_2 - V_1$	
Case 4. Dividend/Repurchase/Investment (market underreaction to share repurchases)				
• $w_1 = w_2 = w_3 = 1/3$	{I, R} {I, I}	(- , +) (0 , 0)	(+ , -) (+ , -)	Firm *H* chooses to invest in a positive NPV project while firm *L* repurchases shares if private benefit is lower than the gain from sending a false signal and the loss from repurchasing shares but invests in the new project otherwise.
• $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$	{I, I}	(0 , 0)	(+ , -)	If the market underreacts to share repurchase announcements, firm *L* cannot get any benefit from sending false signal to the market. Thus, there is no pooling equilibrium in which both firms repurchase shares. To invest in the new project, the manager requires higher private benefit as he places higher weight on short-term payoff.
• $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$	{I, R} {I, I}	(- , +) (0 , 0)	(+ , -) (+ , -)	Firm *H* chooses to invest in a positive NPV project while firm *L* repurchases shares if private benefit is lower than the gain from sending a false signal and the loss from repurchasing shares. To invest in the new project, the manager requires lower private benefit as he places higher weight on long-term payoff.

Table 3.1 Summary of Equilibrium Strategies (Model 1) (Continued)

	Equilibrium	Effects on Firm Value (*H*, *L*)		Intuition
		$V_1 - V_0$	$V_2 - V_1$	
Case 5. Dividend/Repurchase/Investment $(r_H < r_L < 0)$				
• $w_1 = w_2 = w_3 = 1/3$	{R, R} {R, I} {I, I}	(0 , 0) (+ , -) (0 , 0)	(+ , -) (0 , 0) (- , -)	Firm *H* commits not to take a negative NPV project if the private benefit is low (i.e., a share repurchase mitigates overinvestment problem) but invests in a negative NPV project if the private benefit is high (moral hazard problem). Firm *L* chooses to invest in a new project to take private benefit.
• $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$	{R, R} {I, I}	(0 , 0) (0 , 0)	(+ , -) (- , -)	Myopic managers want to announce a share repurchase programme to increase their short-term firm values. However, they choose to invest in negative NPV projects if the private benefit is high enough. To invest in the new project, the manager requires higher private benefit as he places higher weight on short-term payoff.
• $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$	{R, R} {I, R} {R, I}	(0 , 0) (- , +) (+ , -)	(+ , -) (+ , -) (0 , 0)	Both firms choose not to invest in negative NPV projects unless the private benefit is sufficiently high. To invest in the new project, the manager requires lower private benefit as he places higher weight on long-term payoff.

3.2 Catering Model

In this section, I develop a catering model in which two types of firms, a high-quality type and a low-quality type, decide to use free cash flows to pay dividends or repurchase shares in order to cater to investors' demand, or alternatively, invest in the new project. It is assumed that the investors place premium for firms paying dividends or repurchasing shares, and react immediately to a dividend announcement but slowly to a share repurchase announcement. The model demonstrates that the firm's payout/investment decision depends on: (1) the gain/loss from investment; (2) the manager's time horizon; (3) the relative magnitudes of dividend and repurchasing premia; and (4) the degree of information asymmetry. Both adverse selection and moral hazard problems are addressed in this model. Specifically, I demonstrate that the high-quality firm's manager may pass up a positive NPV project in order to cater to investors' strong demand for dividends or share repurchases (an adverse selection problem). Thus, paying dividends or repurchasing shares is inefficient for the high-quality firm. On the other hand, the low-quality firm's manager has a strong incentive to return free cash flows to shareholders if the catering premia are higher than the private benefits from investing in a negative NPV project. Therefore, the moral hazard problem is alleviated under this case.

3.2.1 Introduction

In a frictionless market, Miller and Modigliani's (1961) dividend irrelevance theorem indicate that the value of the firm is independent of the firm's payout policy, implying that dividends and share repurchases are perfect substitutes. In practice, however, the choices of payouts differently affect the firm's market value. For instance, in February 2006, UBS announced that its net profit in the fourth-quarter of 2005 more than tripled and it would increase its payout to shareholders to 3.80 francs a share from 3.00 francs a share in 2004 and buy back as much as an additional five billion francs of shares after a buy back valued at 3.6 billion francs. However, UBS shares fell 1.50 francs, or 1.1%, after the announcement. Analysts reasoned that "investors were disappointed that UBS hadn't increased its dividends even further." (*Wall Street Journal*, February 15, 2006).

As demonstrated by the above article, the payout policy is *not* irrelevant. In the case of UBS, its shareholders appear to exhibit high demand for dividends. Considering the investor demand for dividends as a key determinant for corporate payout policy, Baker and Wurgler (2004a, b) propose a catering theory of dividends, stating that manager's decision to pay dividends is driven by the premium investors place on dividend paying firms. That is, managers cater to investors by paying dividends when investors put a premium on dividend payers, and by not paying dividends when investors prefer non dividend payers. They develop a model in which the manager trades off between a short-run stock price affected by investors' demand for dividends and a long-run fundamental value determined by investment policy. The model predicts that the propensity to pay dividends is increasing in the dividend premium, the difference between the current stock prices of payers and nonpayers, and decreasing in the fundamental cost of dividends (e.g., costly external finance or taxes).

Fairchild and Zhang (2005) further develop Baker and Wurgler's (2004a, b) model, incorporating the repurchasing premium placed by investors as an important factor the managers consider in issuing their payout policy. Their model demonstrates that the firm's incentives to cater through dividends or repurchases, or to retain cash flows to invest in a positive NPV project depends on the manager's time horizon and the relative magnitudes of dividend and repurchasing premia.

I extend Fairchild and Zhang's (2005) work by developing a model in which the managers of two firm types, a high-quality firm and a low-quality firm, are using the free cash flows to pay dividends, repurchase shares, or invest in the new project. I focus on the case in which the high-quality type has a positive NPV project while the low-quality type has a negative NPV project (that is, the high-quality type has a better prospect while the low-quality type has a worse prospect).

Observing the management signals, investors update their beliefs regarding the firm types as well as the firm future profitability. However, the investors are irrational in that they do not update their beliefs when observing one firm pays dividends and the other repurchases shares. Moreover, they react strongly and immediately to dividend announcements but with time lag to share repurchase announcements.

I first analyse the case in which the managers receive no private benefit from investment. Thus, it is obvious to notice that in equilibrium the low-quality firm chooses not to invest in an unprofitable project. The low-quality firm's decision depends on the relative magnitudes of dividend premium and repurchase premium. For the high-quality firm, it weighs the gain from investment, the loss from separation (because of the market's mistaken belief that it is the low-quality type if it decides to invest), and the relative sizes of dividend and repurchasing premium. Note that, the firm's payout choice in this model is largely affected by the manager's catering motive rather than by the manager's signalling or timing motive as in the previous model.

Then, I analyse the case in which the managers receive private benefit from investment. I demonstrate that, if the catering premia are sufficiently high and the private benefits are too low, the high-quality firm may pass up a positive NPV project in order to cater to investors' demand for dividends or share repurchases (an adverse selection problem) while the low-quality firm may return free cash flows to shareholders (the agency cost of free cash flows is mitigated).

3.2.2 The Model

I develop Fairchild and Zhang's (2005) model as follows.

Consider a three-period economy consisting of two all-equity firms whose types $i = \{H, L\}$, where H denotes a high-quality type and L denotes a low-quality type. The interest rate is zero and all participants are risk-neutral in this economy.

Date 0: Each firm i has a one-period project in place, which will generate a cash flow of I for certainty at date 1, and also a three-period project, which may succeed or fail with equal probability. If it succeeds, it will generate a date-3 cash flow of Z^H; if it fails, it will generate a date-3 cash flow of Z^L, where $Z^H > Z^L$ and $\frac{Z^H + Z^L}{2} = \overline{Z}$. The market cannot observe the firm types, and it assigns equal probability to each firm being H or L. Hence, the market values of both firms at this date are the same: $V_{0H} = V_{0L} = I + \overline{Z}$.

Date 1: A new project becomes available. This project requires an investment I. That is, the manager must use all cash flow from the one-period project to finance this new project. This new project will provide a date-2 cash flow X^H for firm H and X^L for firm L, where $X^H > I > X^L$. That is, firm H has a positive NPV project available whereas firm L has a negative NPV project available for investment. It is assumed that there is information asymmetry between the managers and the investors regarding the availability of this project. Specifically, the investors do not expect the firms to reinvest the cash flow I in any real project, but to invest it in financial securities, providing zero NPV.

Rather than invest in the new project, the managers can pay dividends or repurchase shares. Following Baker and Wurgler (2004a, b), I assume that investors place a premium on dividend paying firms. In addition, as in Fairchild and Zhang (2005), investors also place a premium on repurchasing firms. Moreover, I assume that the investors react immediately to dividend announcements but respond with time lag to share repurchase announcements.[9] That is, there is no catering premium at

[9] Ikenberry, Lakonishok, and Vermaelen (1995) report that the market underreacts to open market share repurchases, with the average abnormal four-year buy-and-hold return of 12% after initial announcements. The market underreaction to open market share repurchases can be considered in the framework of *behavioural finance*. For example, market over- and under-reaction to corporate news features in the investor-sentiment model of Barberis, Shleifer and Vishny (1998), and the investor-psychological-bias model of Daniel, Hirshleifer and Subrahmanyam (1998).

date 1 if the manager decides to repurchase shares ($\lambda_1^R = 0$).Further, the repurchasing premium at date 2 is assumed to be higher than the dividend premium at date 1 ($\lambda_2^R > \lambda_1^D$).

The manager makes his date-1 reinvestment/payout decision to maximise his payoff M_i, which is specified as

$$M_i = w_1 V_1 + w_2 V_2 + w_3 B \text{ ,} \tag{1}$$

where V_1 and V_2 are the expected market values of the firm at date 1 and date 2 respectively; w_1, w_2, w_3 represent the managerial weight parameter at date 1, date 2, and date 3 respectively; and $B > 0$ is the private benefits from investment received at date 3 if the manager decides to invest at date 1.

3.2.3 Market's Posterior Beliefs

I specify the market's posterior beliefs as it observes the firms' strategy combination (s_H, s_L), where $s_i = \{D, R, I\}$, as follows:

a) Observing both firms playing identical strategies (I, I), (D, D) or (R, R), the market cannot distinguish the firm types and continues to assign equal probability to each firm being type *H* or *L*.
b) Observing (R, D), the market distinguishes firm types as (H, L).
c) Observing one firm invests in the new project while the other firm pays dividends or repurchases shares, the market believes that the firm investing in the new project is type *L* and the other firm is type *H*.

Date 2: If the managers invested in the new project at date 1, the cash flow is now realised. If the manager did not invest at date 1 but instead repurchased shares, the firm value increases to $V_2 = V_1 + \lambda_2^R$, where λ_2^R represents the date-2 repurchasing premium. If the manager paid dividends at date 1, the firm value stays unchanged. Note that, there is no dividend premium at date 2 because the investors already placed the entire dividend premium at date 1.

Date 3: The manager receives private benefit from investment if he decided to invest at date 1.

3.2.4 Managerial Payoffs

In this catering game, each firm has three policy decisions: invest in the new project, pay dividends, or repurchase shares, denoted by $s_i = \{I, D, R\}$ respectively. Therefore, there are nine strategy combinations (s_H, s_L) to be analysed as follows.

i) Both firms invest in the new project

At date 1, the market observes (I, I) and cannot separate the firm types. Hence, the market values of both firms at date 1 are still the same as those at date 0.

$$V_{1H} = V_{1L} = I + \overline{Z}.$$

At date 2, the cash flow from the date-1 investment is realised. The market continues to believe that the date-3 project will succeed or fail with equal probability. Hence, the market values of both firms are

$$V_{2H} = \overline{Z} + X^H.$$
$$V_{2L} = \overline{Z} + X^L.$$

Substituting firm market values at date 1 and date 2 into equation (1) yields

$$M_H(I,I) = w_1(I+\overline{Z}) + w_2(\overline{Z}+X^H) + w_3 B \tag{2}$$

$$M_L(I,I) = w_1(I+\overline{Z}) + w_2(\overline{Z}+X^L) + w_3 B \tag{3}$$

ii) Both firms pay dividends

At date 1, the market observes (D,D) and cannot separate the firm types. However, the investors place the catering premium, $\lambda_1^{\ D}$, to the firms paying dividends. Hence, the market values of both firms are

$$V_{1H} = V_{1L} = I + \overline{Z} + \lambda^D$$

At date 2, the market continues to believe that the date-3 project will succeed or fail with equal probability. Hence, the market values of both firms are

$$V_{2H} = V_{2L} = I + \overline{Z} + \lambda^D$$

Substituting firm market values at date 1 and date 2 in equation (1) yields

$$M_H(D,D) = w_1(I+\overline{Z}+\lambda^D) + w_2(I+\overline{Z}+\lambda^D) \tag{4}$$

$$M_L(D,D) = w_1(I+\overline{Z}+\lambda^D) + w_2(I+\overline{Z}+\lambda^D) \tag{5}$$

iii) Both firms repurchase shares

Observing (R,R), the market cannot distinguish the firm types. However, it reacts to the share repurchase announcement with time lag. Therefore, the market values of both firms at date 1 are still the same as those at date 0.

$$V_{1H} = V_{1L} = I + \overline{Z}.$$

At date 2, the market does not update its belief regarding the probability of success of the date-3 project. However, it places the catering premium for repurchasing firms. Thus, the market values of both firms are

$$V_{2H} = V_{2L} = I + \overline{Z} + \lambda^R$$

Substituting firm market values at date 1 and date 2 in equation (1) yields

$$M_H(R,R) = w_1\left(I + \overline{Z}\right) + w_2\left(I + \overline{Z} + \lambda^R\right) \tag{6}$$

$$M_L(R,R) = w_1\left(I + \overline{Z}\right) + w_2\left(I + \overline{Z} + \lambda^R\right) \tag{7}$$

iv) Firm *H* invests in the new project while firm *L* pays dividends

The investors observe $(I, D)$and distinguish the firm types as(L, H). Therefore, the market values of both firms at date 1 are

$$\begin{aligned} V_{1H} &= I + Z^L \\ V_{1L} &= I + Z^H + \lambda^D \end{aligned}$$

At date 2, the cash flow from the date-1 project is realised for high-quality type. The market values of both firms are

$$\begin{aligned} V_{2H} &= Z^L + X^H \\ V_{2L} &= I + Z^H + \lambda^D \end{aligned}$$

Substituting firm market values at date 1 and date 2 in equation (1) yields

$$M_H(I,D) = w_1\left(I + Z^L\right) + w_2\left(Z^L + X^H\right) + w_3 B \tag{8}$$

$$M_L(I,D) = w_1\left(I + Z^H + \lambda^D\right) + w_2\left(I + Z^H + \lambda^D\right) \tag{9}$$

v) Firm *H* invests in the new project while firm *L* repurchase shares

The investors observe $(I, R)$and distinguish the firm types as(L, H). Therefore, the market values of both firms at date 1 are

$$\begin{aligned} V_{1H} &= I + Z^L \\ V_{1L} &= I + Z^H \end{aligned}$$

At date 2, the cash flow from the date 1 project is realised for the high-quality type. The market values of both firms are

$$\begin{aligned} V_{2H} &= Z^L + X^H \\ V_{2L} &= I + Z^H + \lambda^R \end{aligned}$$

Substituting firm market values at date 1 and date 2 in equation (1) yields

$$M_H(I, R) = w_1\left(I + Z^L\right) + w_2\left(Z^L + X^H\right) + w_3 B \tag{10}$$

$$M_L(I, R) = w_1\left(I + Z^H\right) + w_2\left(I + Z^H + \lambda^R\right) \tag{11}$$

vi) Firm *H* pays dividends while firm *L* invests in the new project

The investors observe(D, I) and distinguish the firm types as(H, L). Therefore, the market values of both firms at date 1 are

$$\begin{aligned} V_{1H} &= I + Z^H + \lambda^D \\ V_{1L} &= I + Z^L \end{aligned}$$

At date 2, the cash flow from the date-1 project is realised for low-quality type. The market values of both firms are

$$V_{2H} = I + Z^H + \lambda^D$$
$$V_{2L} = Z^L + X^L$$

Substituting firm market values at date 1 and date 2 in equation (1) yields

$$M_H(D,I) = w_1\left(I + Z^H + \lambda^D\right) + w_2\left(I + Z^H + \lambda^D\right) \tag{12}$$
$$M_L(D,I) = w_1\left(I + Z^L\right) + w_2\left(Z^L + X^L\right) + w_3 B \tag{13}$$

vii) Firm *H* repurchases shares while firm *L* invests in the new project

The investors observe (R, I) and distinguish the firm types as (H, L). Thus, the market values of both firms at date 1 are

$$V_{1H} = I + Z^H$$
$$V_{1L} = I + Z^L$$

At date 2, the cash flow from the date-1 project is realised for low-quality type. The values of both firms are

$$V_{2H} = I + Z^H + \lambda^R$$
$$V_{2L} = Z^L + X^L$$

Substituting firm values at date 1 and date 2 in equation (1) yields

$$M_H(R,I) = w_1\left(I + Z^H\right) + w_2\left(I + Z^H + \lambda^R\right) \tag{14}$$
$$M_L(R,I) = w_1\left(I + Z^L\right) + w_2\left(Z^L + X^L\right) + w_3 B \tag{15}$$

viii) Firm *H* repurchases shares while firm *L* pays dividends

Observing (R, D), the investors distinguish firm types as (H, L) and attach a catering premium immediately to dividend paying firm but with time lag to repurchasing firm. Thus, the market values of both firms at date 1 are

$$V_{1H} = I + Z^H$$
$$V_{1L} = I + Z^L + \lambda^D$$

At date 2, the values of both firms are

$$V_{2H} = I + Z^H + \lambda^R$$
$$V_{2L} = I + Z^L + \lambda^D$$

Substituting firm market values at date 1 and date 2 in equation (1) yields

$$M_H(R,D) = w_1\left(I + Z^H\right) + w_2\left(I + Z^H + \lambda^R\right) \tag{16}$$
$$M_L(R,D) = w_1\left(I + Z^L + \lambda^D\right) + w_2\left(I + Z^L + \lambda^D\right) \tag{17}$$

ix) Firm *H* pays dividends while firm *L* repurchases shares.

Observing (D, R), investors distinguish firm types as (L, H) and attach the catering premium immediately to dividend paying firm but with time lag to repurchasing firm. Thus, the market values of both firms at date 1 are

$$V_{1H} = I + Z^L + \lambda^D$$
$$V_{1L} = I + Z^H$$

At date 2, the values of both firms are

$$V_{2H} = I + Z^L + \lambda^D$$
$$V_{2L} = I + Z^H + \lambda^R$$

Substituting firm market values at date 1 and date 2 in equation (1) yields

$$M_H(D,R) = w_1\left(I + Z^L + \lambda^D\right) + w_2\left(I + Z^L + \lambda^D\right) \tag{18}$$

$$M_L(D,R) = w_1\left(I + Z^H\right) + w_2\left(I + Z^H + \lambda^R\right) \tag{19}$$

3.2.5 Equilibrium Analysis

The normal-form of this dividend and repurchase catering game is illustrated in Figure 3.5 and all the managerial payoffs are summarised below.

Figure 3.5: Dividend and Repurchase Catering Game

$\boldsymbol{M_H}$ \ $\boldsymbol{M_L}$	D	R	I
D	(4), (5)	(18), (19)	(12), (13)
R	(16), (17)	(6), (7)	(14), (15)
I	(8), (9)	(10), (11)	(2), (3)

$$M_H(I,I) = w_1\left(I + \overline{Z}\right) + w_2\left(\overline{Z} + X^H\right) + w_3 B \tag{2}$$

$$M_L(I,I) = w_1\left(I + \overline{Z}\right) + w_2\left(\overline{Z} + X^L\right) + w_3 B \tag{3}$$

$$M_H(D,D) = w_1\left(I + \overline{Z} + \lambda^D\right) + w_2\left(I + \overline{Z} + \lambda^D\right) \tag{4}$$

$$M_L(D,D) = w_1\left(I + \overline{Z} + \lambda^D\right) + w_2\left(I + \overline{Z} + \lambda^D\right) \tag{5}$$

$$M_H(R,R) = w_1\left(I + \overline{Z}\right) + w_2\left(I + \overline{Z} + \lambda^R\right) \tag{6}$$

$$M_L(R,R) = w_1\left(I + \overline{Z}\right) + w_2\left(I + \overline{Z} + \lambda^R\right) \tag{7}$$

$$M_H(I,D) = w_1\left(I + Z^L\right) + w_2\left(Z^L + X^H\right) + w_3 B \tag{8}$$

$$M_L(I,D) = w_1\left(I + Z^H + \lambda^D\right) + w_2\left(I + Z^H + \lambda^D\right) \tag{9}$$

$$M_H(I,R) = w_1\left(I + Z^L\right) + w_2\left(Z^L + X^H\right) + w_3 B \tag{10}$$

$$M_L(I,R) = w_1\left(I + Z^H\right) + w_2\left(I + Z^H + \lambda^R\right) \tag{11}$$

$$M_H(D,I) = w_1\left(I + Z^H + \lambda^D\right) + w_2\left(I + Z^H + \lambda^D\right) \tag{12}$$

$$M_L(D,I) = w_1\left(I + Z^L\right) + w_2\left(Z^L + X^L\right) + w_3 B \tag{13}$$

$$M_H(R,I) = w_1\left(I + Z^H\right) + w_2\left(I + Z^H + \lambda^R\right) \tag{14}$$

$$M_L(R,I) = w_1\left(I + Z^L\right) + w_2\left(Z^L + X^L\right) + w_3 B \tag{15}$$

$$M_H(R,D) = w_1\left(I + Z^H\right) + w_2\left(I + Z^H + \lambda^R\right) \tag{16}$$

$$M_L(R,D) = w_1\left(I + Z^L + \lambda^D\right) + w_2\left(I + Z^L + \lambda^D\right) \tag{17}$$

$$M_H(D,R) = w_1\left(I + Z^L + \lambda^D\right) + w_2\left(I + Z^L + \lambda^D\right) \tag{18}$$

$$M_L(D,R) = w_1\left(I + Z^H\right) + w_2\left(I + Z^H + \lambda^R\right) \tag{19}$$

Having obtained all the managerial payoffs, I first analyse the case in which $w_1 = w_2 = w_3 = 1/3$. To simplify the analysis, I specify the following assumption

$$(w_1 + w_2)\lambda^D > w_2\left(X^L - I\right) + w_3 B \tag{a1}$$

Lemma 1 *Investing in the new project is dominated strategy for firm L. Firm L's best responses to firm H's strategies are as follows:*

a) *Given that firm H pays dividends, firm L will pay dividends if* $\lambda^D \geq \left(Z^H - Z^L\right) + \frac{\lambda^R}{2}$ *but repurchase shares if* $\lambda^D < \left(Z^H - Z^L\right) + \frac{\lambda^R}{2}$.

b) *Given that firm H repurchases shares, firm L will pay dividends if* $\lambda^D \geq \left(Z^H - Z^L\right) + \frac{\lambda^R}{2}$ *but repurchase shares if* $\lambda^D < \left(Z^H - Z^L\right) + \frac{\lambda^R}{2}$.

c) *Given that firm H invests in the new project, firm L will pay dividends if* $\lambda^D \geq \frac{\lambda^R}{2}$ *but repurchase shares if* $\lambda^D < \frac{\lambda^R}{2}$.

Proof: See Appendix B.

Lemma 1a) and 1b) demonstrate that, if firm *H* pays dividends or repurchases shares, firm *L* will choose to pay dividends if the dividend premium is higher than the sum of the information asymmetry and repurchasing premium but repurchase shares otherwise. Lemma 1c) demonstrates that, if firm *H* invests in the new project, firm *L* will choose to pay dividends if the dividend premium is higher than the repurchasing premium but repurchase shares otherwise.

Lemma 2 *Firm H's best responses to firm L's strategies are as follows:*

a) *Given that firm L pays dividends, firm H will pay dividends if* $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$ *and* $\left(Z^H - Z^L\right) + 2\lambda^D \geq \left(X^H - I\right) + B$*; repurchase shares if* $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$ *and* $2\left(Z^H - Z^L\right) + \lambda^R \geq \left(X^H - I\right) + B$*; and invest in the new project if* $\left(Z^H - Z^L\right) + 2\lambda^D < \left(X^H - I\right) + B$ *and* $2\left(Z^H - Z^L\right) + \lambda^R < \left(X^H - I\right) + B$.

b) *Given that firm L repurchases shares, firm H will pay dividends if* $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$ *and* $2\lambda^D \geq \left(X^H - I\right) + B$*; repurchase shares if* $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$ *and* $\left(Z^H - Z^L\right) + \lambda^R \geq \left(X^H - I\right) + B$*; and invest in the new project if* $2\lambda^D < \left(X^H - I\right) + B$ *and* $\left(Z^H - Z^L\right) + \lambda^R < \left(X^H - I\right) + B$.

Intuitively, lemma 2a) and 2b) demonstrate that, if firm *L* pays dividends or repurchases shares, firm *H* will choose to pay dividends if the dividend premium is higher than both the repurchasing premium and the sum of positive NPV and private benefit; firm *H* will choose to repurchase shares if the repurchasing premium is higher than both the dividend premium and the sum of positive NPV and private benefit; firm *H* will invest in the new project if the sum of positive NPV and private benefit is higher than both the dividend premium and the repurchasing premium.

Proposition 1 *Lemma 1 and lemma 2 provide following strategic equilibria:*

a) *If* $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$, *there exists a pooling equilibrium* (D,D) *if* $\left(Z^H - Z^L\right) + 2\lambda^D \geq \left(X^H - I\right) + B$; *and a separating equilibrium* (I,D) *if* $\left(Z^H - Z^L\right) + 2\lambda^D < \left(X^H - I\right) + B$ *and* $2\left(Z^H - Z^L\right) + \lambda^R < \left(X^H - I\right) + B$.

b) $\frac{\lambda^R}{2} \leq \lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$, *there exists a separating equilibrium* (I,D) *if* $\left(Z^H - Z^L\right) + 2\lambda^D < \left(X^H - I\right) + B$ *and* $2\left(Z^H - Z^L\right) + \lambda^R < \left(X^H - I\right) + B$, *and a pooling equilibrium* (R,R) *if* $\left(Z^H - Z^L\right) + \lambda^R \geq \left(X^H - I\right) + B$.

c) *If* $\lambda^D < \frac{\lambda^R}{2}$, *there exists a separating equilibrium* (I,R) *if* $2\lambda^D < \left(X^H - I\right) + B$ *and* $\left(Z^H - Z^L\right) + \lambda^R < \left(X^H - I\right) + B$; *and a pooling equilibrium* (R,R) *if* $\left(Z^H - Z^L\right) + \lambda^R \geq \left(X^H - I\right) + B$.

Proposition 1a) shows that, if the dividend premium is higher than the sum of information asymmetry and repurchasing premium, firm *L* will unambiguously choose to pay dividends while firm *H* will choose to invest in a new project if the capital gain from investing in a positive NPV project exceeds the information asymmetry cost and the opportunity cost of not catering investors with dividends; however, firm *H* will choose to pay dividends and pass up a positive NPV project (an adverse selection problem) if the capital gain from investment is lower than the total gains from pooling and dividend premium. In a pooling equilibrium (D, D), the market values of both firms are the same $\left(I+\overline{Z}+\lambda^{D}\right)$ at date 1 and stay unchanged at date 2. In a separating equilibrium (I, D), the market value of firm H decreases to $\left(I+Z^{L}\right)$ while the market value of firm L increases to $\left(I+Z^{H}+\lambda^{D}\right)$at date 1. At date 2, the market value of firm H increases to $\left(Z^{L}+X^{H}\right)$ while the market value of firm L is the same as that at date 1.

Proposition 1b) shows that, if the dividend premium is lower than the sum of information asymmetry and repurchasing premium but higher than the repurchasing premium, firm H will choose to invest in the new project if the capital gain from investment exceeds the information asymmetry cost and the opportunity cost of not catering investors with dividends or share repurchases but choose to repurchase shares rather than invest in a new project if the capital gain from undertaking a positive NPV project is lower than the gains from pooling and repurchasing premium. In a separating equilibrium (I, D), the market value of firm H decreases to $\left(I+Z^{L}\right)$ while the market value of firm L increases to $\left(I+Z^{H}+\lambda^{D}\right)$at date 1. At date 2, the market value of firm H increases to $\left(Z^{L}+X^{H}\right)$ while the market value of firm L is the same as that at date 1. In a pooling equilibrium (R, R), the market values of both firms are the same $\left(I+\overline{Z}\right)$ at date 1 and increase to $\left(I+\overline{Z}+\lambda^{R}\right)$at date 2.

Proposition 1c) shows that, if the dividend premium is lower than the repurchasing premium, firm L will unambiguously choose to repurchase shares whereas firm H will choose to invest in a new project if the capital gain from investing in a positive NPV project is higher than the information asymmetry cost and the opportunity cost of not catering investors with share repurchases. Nevertheless, firm H will choose to buy back shares rather than invest in a new project if the capital gain from undertaking a positive NPV project is lower than the total gains from pooling and repurchase premium. In a separating equilibrium (I, R), the market value of firm H decreases to $\left(I+Z^{L}\right)$ while the market value of firm L increases to $\left(I+Z^{H}\right)$at date

1. At date 2, the market values of firm H and firm L increase to $\left(Z^L + X^H\right)$ and $\left(I + Z^H + \lambda^R\right)$ respectively. In a pooling equilibrium (R, R), the market values of both firms are the same $\left(I + \overline{Z}\right)$ at date 1 and increase to $\left(I + \overline{Z} + \lambda^R\right)$ at date 2.

Corollary 1 If *the manager is myopic* $\left(e.g., w_1 = 0.6, w_2 = 0.3, w_3 = 0.1\right)$, *there exist following equilibria:*

a) *If* $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$, *there exists a pooling equilibrium* (D, D) *if* $9\left(\frac{Z^H - Z^L}{2}\right) + 9\lambda^D \geq 3\left(X^H - I\right) + B$ *; and a separating equilibrium* (I, D) *if* $9\left(\frac{Z^H - Z^L}{2}\right) + 9\lambda^D < 3\left(X^H - I\right) + B$ *and* $9\left(Z^H - Z^L\right) + 3\lambda^R < 3\left(X^H - I\right) + B$.

b) $\frac{\lambda^R}{3} \leq \lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$, *there exists a separating equilibrium* (I, D) *if* $9\left(\frac{Z^H - Z^L}{2}\right) + 9\lambda^D < 3\left(X^H - I\right) + B$ *and* $9\left(Z^H - Z^L\right) + 3\lambda^R < 3\left(X^H - I\right) + B$, *and a pooling equilibrium* (R, R) *if* $9\left(\frac{Z^H - Z^L}{2}\right) + 3\lambda^R \geq 3\left(X^H - I\right) + B$.

c) *If* $\lambda^D < \frac{\lambda^R}{3}$, *there exists a separating equilibrium* (I, R) *if* $9\lambda^D < 3\left(X^H - I\right) + B$ *and* $9\left(\frac{Z^H - Z^L}{2}\right) + 3\lambda^R < 3\left(X^H - I\right) + B$ *; and a pooling equilibrium* (R, R) *if and* $9\left(\frac{Z^H - Z^L}{2}\right) + 3\lambda^R \geq 3\left(X^H - I\right) + B$.

Proof: See Appendix B.

The equilibria in the case where the manager places higher weight on short-term benefits are the same as those in the case where the manager balances his payoffs at three dates. However, the manager is more likely to pay dividends than to repurchase shares or to invest in the new project. That is, the higher the short-term managerial weight, the lower the dividend premium the manager needs for paying dividends.

Corollary 2 *If the manager is farsighted* $(e.g., w_1 = 0.1, w_2 = 0.3, w_3 = 0.6)$*, there exist following equilibria:*

a) *If* $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$*, there exist a pooling equilibrium* (D, D) *if* $2(Z^H - Z^L) + 4\lambda^D \geq 3(X^H - I) + 6B$*; and a separating equilibrium* (I, D) *if* $2(Z^H - Z^L) + 4\lambda^D < 3(X^H - I) + 6B$ *and* $4(Z^H - Z^L) + 3\lambda^R < 3(X^H - I) + 6B$.

b) $\frac{3}{4}\lambda^R \leq \lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$*, there exist a separating equilibrium* (I, D) *if* $2(Z^H - Z^L) + 4\lambda^D < 3(X^H - I) + 6B$ *and* $4(Z^H - Z^L) + 3\lambda^R < 3(X^H - I) + 6B$*, and a pooling equilibrium* (R, R) *if* $2(Z^H - Z^L) + 3\lambda^R \geq 3(X^H - I) + 6B$.

c) *If* $\lambda^D < \frac{3}{4}\lambda^R$*, there exist a separating equilibrium* (I, R) *if* $4\lambda^D < 3(X^H - I) + 6B$ *and* $9\left(\frac{Z^H - Z^L}{2}\right) + 3\lambda^R < 3(X^H - I) + B$*; and a pooling equilibrium* (R, R) *if and* $2(Z^H - Z^L) + 3\lambda^R < 3(X^H - I) + 6B$.

Proof: See Appendix B.

The equilibria in the case where manager places higher weight on long-term benefits are the same as those in the case where manager balances his payoffs. However, the manager is less likely to pay dividends than to repurchase shares or to invest in the new project. That is, the higher the long-term managerial weight, the higher the dividend premium the manager needs for paying dividends.

3.2.6 Summary of Equilibrium Strategies

The equilibrium strategies, the effects on firm value, and the intuitions behind the outcomes of this dividend and repurchase catering model are summarised in Table 3.2 below.

Table 3.2 Summary of Equilibrium Strategies (Model 2)

	Equilibrium	Effects on Firm Value (*H*, *L*)		Intuition
		$V_1 - V_0$	$V_2 - V_1$	
• $w_1 = w_2 = w_3 = 1/3$	{D, D} {I, D}	(+ , +) (- , +)	(0 , 0) (+ , 0)	If $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$, firm *L* always pays dividends; firm *H* pays dividends if dividend premium is higher than project's return plus private benefit but invests in the new project if dividend premium is lower than project's return plus private benefit.
	{R, R} {I, D}	(0 , 0) (- , +)	(+ , +) (+ , 0)	If $\frac{\lambda^R}{2} \leq \lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$, firm *H* weighs relative benefits between repurchasing shares and investing in a new project while firm *L* weighs relative benefits between paying dividends and repurchasing shares.
	{R, R} {I, R}	(0 , 0) (- , +)	(+ , +) (+ , +)	If $\lambda^D < \frac{\lambda^R}{2}$, firm *L* always repurchases shares; firm *H* invests in a new project if the repurchasing premium is lower than the project's return plus private benefit but repurchase shares if the repurchasing premium is higher than the project's return plus private benefit.

Table 3.2 Summary of Equilibrium Strategies (Model 2) (continued)

	Equilibrium	Effects on Firm Value (*H*, *L*)		Intuition
		$V_1 - V_0$	$V_2 - V_1$	
• $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$	{D, D} {I, D}	(+ , +) (- , +)	(0 , 0) (+ , 0)	If $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$, firm *L* always pays dividends; firm *H* pays dividends if dividend premium is higher than project's return plus private benefit but invests in the new project if dividend premium is lower than project's return plus private benefit.
	{R, R} {I, D}	(0 , 0) (- , +)	(+ , +) (+ , 0)	If $\frac{\lambda^R}{3} \leq \lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$, firm *H* weighs relative benefits between repurchasing shares and investing in a new project while firm *L* weighs relative benefits between paying dividends and repurchasing shares.
	{R, R} {I, R}	(0 , 0) (- , +)	(+ , +) (+ , +)	If $\lambda^D < \frac{\lambda^R}{3}$, firm *L* always repurchases shares; firm *H* invests in a new project if the repurchasing premium is lower than the project's return plus private benefit but repurchase shares if the repurchasing premium is higher than the project's return plus private benefit.

Table 3.2 Summary of Equilibrium Strategies (Model 2) (continued)

	Equilibrium	Effects on Firm Value (H, L)		Intuition
		$V_1 - V_0$	$V_2 - V_1$	
• $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$	{D, D} {I, D}	(+ , +) (- , +)	(0 , 0) (+ , 0)	If $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$, firm *L* always pays dividends; firm *H* pays dividends if dividend premium is higher than project's return plus private benefit but invests in the new project if dividend premium is lower than project's return plus private benefit.
	{R, R} {I, D}	(0 , 0) (- , +)	(+ , +) (+ , 0)	If $\frac{3}{4}\lambda^R \leq \lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$, firm *H* weighs relative benefits between repurchasing shares and investing in a new project while firm *L* weighs relative benefits between paying dividends and repurchasing shares.
	{R, R} {I, R}	(0 , 0) (- , +)	(+ , +) (+ , +)	If $\lambda^D < \frac{3}{4}\lambda^R$, firm *L* always repurchases shares; firm *H* invests in a new project if the repurchasing premium is lower than the project's return plus private benefit but repurchase shares if the repurchasing premium is higher than the project's return plus private benefit.

3.3 Summary

I have developed two theoretical models related to corporate payout policy. The first model, developed in spirit of Isagawa (2000), presents a situation in which the managers of two firm types, a low-quality firm and a high-quality firm, decide whether to use the free cash flows to pay dividends, repurchase shares, or invest in a real project. This model demonstrates that a share repurchase programme can be used by managers to signal undervaluation, to time the market, or to mitigate overinvestment problem. The second model, built on Fairchild and Zhang' (2005) work, is a catering model in which the managers of two firm types, a low-quality firm and a high-quality firm, decide whether to use the free cash flows to pay dividends or repurchase shares in order to cater to investors' strong demand for cash payout, or, alternatively, invest in a real project. This model shows that payout policy is driven by the premium the investors place on the dividend-paying and repurchasing firms.

The first model is analysed in two versions. In model version 1, in which the efficient market is assumed, paying dividends is a dominated strategy for firm *H* regardless of the return from the project and the managerial weight parameter. Hence, manager of firm *H* only considers the choice between investing in the new positive NPV project from which he also gets private benefits and repurchasing undervalued shares to signal his firm type.

When the manager balances his short-term and long-term payoffs, there exist three equilibria: (1) a separating equilibrium in which firm *H* invests in the new project while firm *L* repurchase shares if the private benefit is large enough for firm *H* but too small for firm *L*; (2) a pooling equilibrium in which both firms repurchase shares if the private benefit is too low for both firms; and (3) a pooling equilibrium in which both firms invest in the new project if the private benefit is high enough for both firms.

When the manager places higher weight on short-term payoff, both firms are more likely to repurchase shares than to invest in the new project. If the private benefit is sufficiently high, however, both firms will choose to invest in the new projects. To invest in the new project, the manager requires higher private benefit than that in the case where he balances the payoffs at three dates. On the other hand, when the manager places higher weight on long-term payoff, both firms are more likely to invest in the new projects. To invest in the new project, the manager requires lower private benefit than that in the case where he balances the payoffs at three dates. That is, the higher the long-term managerial weight, the lower the private benefits the manager needs for undertaking the new project, and vice versa.

In model version 2, I consider the case in which the investors are irrational in that they do not update their beliefs upon observing one firm repurchases shares and the other pays dividends. When the manager places equal weight on his short-term and long-term payoffs, I obtain a separating equilibrium in which firm *H* invests in the new project while firm *L* repurchase shares if the private benefit is large enough for firm *H* but too small for firm *L*, and a pooling equilibrium in which both firms invest in the new project if the private benefit is high enough for both firms. Note that, I do not obtain a pooling equilibrium in which both firms repurchase shares as in version 1 because firm *L* has no incentive to mimic if the market underreacts to shares repurchase announcements.

When the manager places higher weight on his short-term payoff, there is a pooling equilibrium in which both firms invest in the new project. There is no pooling equilibrium in which both firms repurchase shares because firm *L* has no benefit from announcing a share repurchase program. Note that, for a pooling equilibrium in which both firms invest in the new project to be obtained, the manager needs higher private benefits as he places more weight on short-term payoff. Conversely, when the manager places higher weight on his long-term payoff, firm *H* always chooses to invest in the new project while firm *L* repurchases shares if the private benefit is too low but invests in the new project if the private benefit is high. Thus, there exist a separating equilibrium in which firm *H* invests in the new project while firm *L* repurchases shares and a pooling equilibrium in which both firms invest in the new projects. Note that, for a pooling equilibrium in which both firms invest in the new project to be obtained, the manager needs lower private benefits as he places more weight on long-term payoff.

I further consider the case in which a share repurchase may be used to mitigate the agency cost of free cash flows. Assuming that both firms have a negative NPV project available, I derive a separating equilibrium in which firm *H* repurchases shares while firm *L* invests in the new project when the private benefit is low. The result that the firm with a low private benefit may repurchase shares in order to commit not to undertake a negative NPV project (i.e., a share repurchase helps mitigate the agency cost of free cash flows) is consistent with Isagawa (2000).

The second model is the extension of Fairchild and Zhang's (2005) model. It considers the case in which the managers of two firm types, a high-quality firm and a low-quality firm, decide whether to use the free cash flow to pay dividends, repurchase shares, or invest in the new project. The manager's dividend and repurchase catering motives are introduced in this model. In particular, it is assumed that the investors are irrational in that: (1) they do not update their beliefs upon observing one firm repurchases shares and the other pays dividends; (2) they place both dividend premium and repurchasing premium on dividend-paying firm and repurchasing firm respectively; and (3) they respond immediately to dividend announcements but with time lag to share repurchase announcements.

The model demonstrates that the firm's payout policy depends on: (1) the gain/loss from investment; (2) the manager's time horizon; (3) the relative magnitudes of dividend and repurchasing premia; (4) the degree of information asymmetry; and (5) the private benefits from investment. Both adverse selection and moral hazard problems are addressed in this model. Specifically, the high-quality firm may pass up a positive NPV project if the catering premia are sufficiently high (adverse selection problem). The model also shows that the higher weight the manager places on the short-term payoff, the lower dividend premium he requires for paying dividends. On the other hand, the higher weight the manager places on the long-term payoff, the higher dividend premium he requires for paying dividends. Fairchild (2008) suggests that this adverse selection problem may be mitigated by communication to investors, reinforced by managerial reputation effects. On the other hand, the low-quality firm has a strong incentive to return the free cash flows to shareholders if the catering premia are higher than the private benefits from investing in a negative NPV project. Hence, the moral hazard problem is mitigated in the latter case.

In sum, I demonstrate that the relationship between managerial motives and payout policies is indeed complex. That is, the corporate payout choices can be driven by the manager's motives to signal firm value, to time the market, to cater to investors' demand, to take private benefits, or to mitigate overinvestment problem. I believe that my models shed additional light on the dividend puzzle and provide direction for future theoretical and empirical research on corporate payout policy.

In the next chapter, I investigate the dividend changes in Thailand over the period 2002-2005. The focus is to test the two competing theories in dividend literature: the signalling and the free cash flow hypotheses.

CHAPTER 4

Empirical Investigation of Dividend Changes in Thailand

This chapter provides empirical evidence on dividend changes in Thailand over the period 2002-2005. To test the signalling and the free cash flow hypothesis, which are the focuses of my investigation, I first analyse the changes in profitability of sample firms around dividend changes and benchmark them with those of control firms. Then, regression analyses are undertaken to examine the relation between dividend changes and the past and future profitability, as well as to determine significant factors of dividend changes. Next, I investigate the short-run and long-run stock price performance of dividend-changing firms, and the relation between announcement returns and hypothesised independent variables. Finally, I examine investment behaviours of the sample firms following dividend changes.

4.1 Methodology

Two main approaches, benchmark analysis and regression analysis, are employed in this study to examine whether dividend changes by Thai firms convey information about future earnings and profitability. The aim is to test the following predictions of the dividend-signalling hypothesis:

1) Firms that increase (decrease) dividends will have significantly positive (negative) unexpected earnings and profitability changes in subsequent years.
2) The stock market reacts positively to dividend increase announcements but negatively to dividend decrease announcements.
3) The larger the dividend changes, the stronger the stock market reactions.

To test the first prediction, I first examine the raw earnings changes of dividend-changing firms. This approach implicitly assumes that earnings follow random walks. Then, I benchmark the earnings growths of dividend-changing firms with those of firms in the same industries that keep their dividends unchanged. If the signalling hypothesis is supported, subsequent industry-adjusted earnings growths of dividend-increasing (dividend-decreasing) firms should be significantly positive (negative).

Following the suggestion of Barber and Lyon (1996)[10], I also compare the earnings performance of dividend-changing firms with that of no-change firms that experience similar earnings growth between year -1 and year 0 (dividend-change year). Similarly, the subsequent performance-adjusted earnings growths of dividend-increasing (dividend-decreasing) firms should be significantly positive (negative) if the signalling hypothesis is true.

As robustness check of whether dividend changes signal future profitability, I repeat the benchmark analyses by examining the ROA changes around dividend changes.

Next, regression analyses are undertaken to examine the relationship between dividend changes and future earnings changes. Specifically, I run the simple regressions between future earnings change as the dependent variable and dividend change as the independent variable. To check the robustness, I repeat the regressions replacing earnings changes with ROA changes.

Subsequently, I determine the factors that have significant association with dividend changes. In particular, I regress the dividend change as the dependent variable against hypothesised independent variables, i.e., the past ROA changes[11], firm size, MTB ratio, cash flow, retained earnings to equity, debt ratio, and past dividend yield. To make it easy to follow, the univariate analysis is first used to determine the significance of each variable. Then, the multivariate analysis is applied to determine significant determinants explaining the size of dividend changes. Further, I run the logit regressions on these hypothesised variables to identify the

[10] To detect the firm's abnormal performance, Barber and Lyon (1996) recommend that sample firms be benchmarked with control firms with similar performance.
[11] ROA changes are used instead of earnings changes because ROA changes have more explanatory power.

significant factors affecting the probability that firms increase or decrease dividends (or keep them unchanged).

To test the second prediction, I employ the standard event methodology to measure the initial market reactions to dividend changes. In particular, I measure the 3-day (-1, +1) cumulative abnormal returns (CARs) surrounding the dividend announcement date as follows:

$$CAR_i = \sum_{t=-1}^{t=1} AR_{i,t} \ , \qquad (4.1)$$

where $AR_{i,t}$ is the abnormal return of each security i on day t, compared with the return of the value-weighted SET index.

I also measure the long-run price performance in order to observe the stock market reactions to the firms' financial performance after dividend changes by calculating the market-adjusted buy-and-hold returns as follows:

$$BHAR_i = \prod_{t=a}^{b}(1+R_{it}) - \prod_{t=a}^{b}(1+M_t), \qquad (4.2)$$

where R_{it} is the return on stock i on month t and M_t is the return on the SET value-weighted market portfolio on month t.

To test the third prediction, I first run the simple regression between CAR and the magnitude of dividend changes. I then identify other significant determinants of the initial stock market reactions by running multiple regressions between CAR and potential explanatory variables such as firm size, market-to-book ratio, and free cash flow.

While I devote a large part of this study to test the signalling hypothesis, I also investigate the following implications of the free cash flow hypothesis:

1) The stock market reacts more positively to a dividend increase by firms with low investment opportunities and high cash flows (which tends to have overinvestment problem) than to a dividend increase by firms with high investment opportunities and low cash flows.
2) Dividend increases by low growth firms will be followed by significant decreases in subsequent investments.

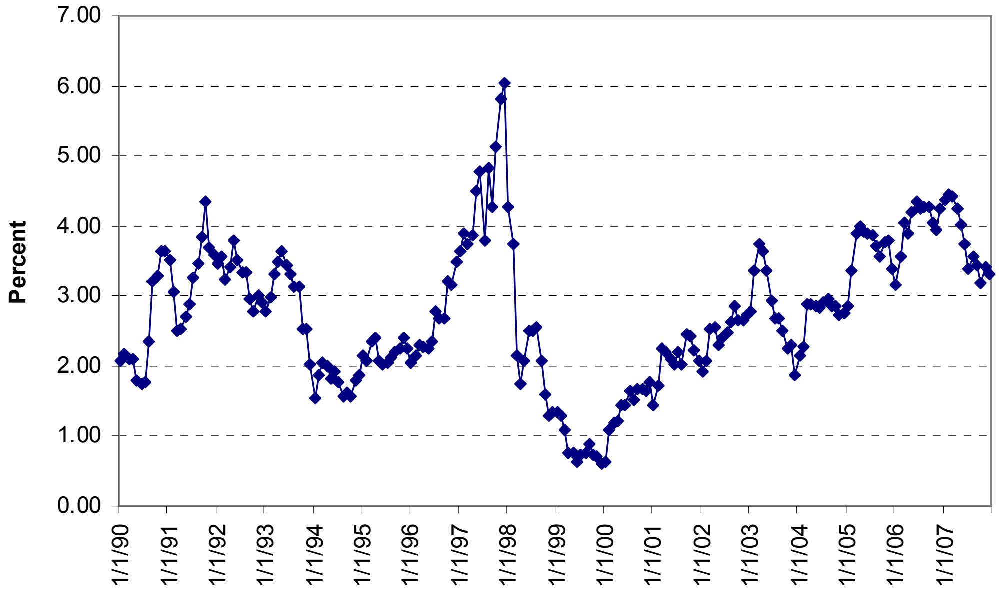
The first implication is tested by examining the relationship between CAR and proxy for growth opportunities, i.e., market-to-book ratio, controlling for the size of dividend changes. The second implication is tested by running regressions between subsequent capital expenditures and the dividend changes.

4.2 The Sample

The data on dividend policy in Thailand is obtained from various sources such as SETSMART (SET Market Analysis and Reporting Tool) via www.setsmart.com, the web-based application of the Stock Exchange of Thailand, and other two official websites of the Stock Exchange of Thailand: www.set.or.th and www.settrade.com. The financial data of sample firms is primarily drawn from www.securities.com, the website of Euromoney Institutional Investor PLC., which contains comprehensive financial data on emerging markets. The data on historical stock prices is retrieved from www.kimeng.co.th, the website of KIMENG Securities Thailand (PLC), a securities broker company in Thailand.

Since I study the dividend changes by the publicly traded firms in the Stock Exchange of Thailand (SET) over the period 2002 - 2005, the data on dividends from years 2001 to 2005 must be available in order to calculate dividend changes. I choose to study dividend changes in Thailand in such a period because many Thai firms made huge losses and thus omitted dividends during the Asian financial crisis between 1997 and 2000 (Please see the monthly dividend yield of Thai stock market from January 1990 to December 2007 as shown in Figure 4.1 below). In addition, the choice of the sample period is limited by the requirement that at least 2 years of financial data be available before and after the dividend announcement date.

Figure 4.1: Monthly Dividend Yield in Thailand (Jan 1990 - Dec 2007)



Source: The Stock Exchange of Thailand

Figure 4.1 shows that the dividend yield of Thai listed firms was normally in the range 1.5% - 4.5% before the Asian financial crisis. However, the dividend yield increased dramatically, due to the steep drop in equity prices, shortly after the Thai currency was floated in July 1997 and then fell sharply because many firms were defunct or omitted dividends during the crisis. The dividend yield started to recover in year 2000 and was in its normal range again in year 2001.

To obtain the dividend change data, I first examine the dividend payments of 411 firms, excluding financial firms and property funds, listed on the SET[12] between

[12] The other smaller board is the MAI (Market for Alternative Investment), which is for small and midsize firms to be traded.

2001 and 2005. Specifically, I identify the dividend per share[13] paid by these firms and calculate the annual percentage changes as follows

$$DIV_0 = \frac{DIV_0 - DIV_{-1}}{DIV_{-1}}, \tag{4.3}$$

where DIV_0 is dividend per share in the dividend change year (year 0) and DIV_{-1} is dividend per share in one year prior to the dividend change year.

I also indentify the dividend announcement date, which is defined as the first date at which the news about the firm's board of directors' approval of dividend payment become available on www.settrade.com,[14] for the purpose of measuring stock market reactions to dividend change announcements.

To be included in the sample, the dividend data must satisfy the following criteria:

i) The dividend data, including dividend announcement date, must be available on SETSMART.
ii) The firm must pay dividend annually or semi-annually[15] (4 firms paying quarterly dividends are excluded from the sample).
iii) The firm must pay dividends at least two consecutive years in the sample period in order to calculate dividend changes.
iv) If there is a stock split during the sample period, dividend per share must be adjusted accordingly.
v) The percentage change in dividends must be at least 10% but not exceed 500%. The lower bound of 10% ensures that only significant dividend

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[13] Using level of annual dividends does not significantly alter the results.

[14] It is a requirement that public companies submit the resolutions of their board of directors to the SET within one business day after the meetings. The information is then immediately announced via www.settrade.com in "company news" section.

[15] Most listed firms in Thailand pay dividends annually i.e. they make dividend announcements in the first quarter of fiscal year, mostly in February or March.

changes are included in the sample while the upper bound of 500% eliminates the outliers.[16]

vi) The dividend announcement is not an initiation or an omission.

In order to examine the relation between dividend changes and various financial variables as well as to measure the short-run and long-run abnormal stock returns around dividend changes, additional following criteria must be satisfied:

vii) The firm's financial data must be available on www.securities.com and the daily and monthly stock returns over one year before and two years after dividend announcements must be available on www.kimeng.co.th.

viii) No other corporate announcements such as stock splits, stock dividends, stock repurchases, mergers and acquisitions, and so on are made within 15 trading days surrounding dividend announcement date. This is to ensure that dividend announcement is not contaminated by non-dividend events so that I can correctly detect the abnormal stock returns surrounding dividend changes.

The final sample covers 168 firms and 320 dividend changes, comprising 206 dividend increases and 114 decreases. 87 dividend announcements are classified as no-change announcements.

4.3 Definitions of Variables

For each dividend change announcement, I collected from www.kimeng.co.th the daily stock and SET index returns during the 3-day window, from one day before to one day after the announcement, in order to calculate the market-adjusted cumulative abnormal returns (CARs) of dividend changes, and the monthly stock and SET index returns from one year before to two years after the announcement in order to calculate the market-adjusted buy-and-hold returns (BHARs).

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[16] This criterion removed 5 dividend increases above 500% from the sample.

Several variables are employed to test the dividend-signalling hypothesis and the free cash flow hypothesis. These variables include dividend change (ΔDIV_0), earnings change (ΔE_t), ROA change (ΔROA_t), firm size (*SIZE*), market-to-book ratio (*MTB*), cash flow (*CF*), retained earnings to equity (*RTE*), debt ratio (*DTA*), dividend yield (*YLD*), and change in capital expenditures ($\Delta CAPEX_t$). Each variable is defined as follows:

a) Dividend change (ΔDIV_0) is defined as in equation 4.3 above.

b) Earnings change (ΔE_t)

As a measure of firm's profitability, earnings change is calculated as

$$\Delta E_t = \frac{E_t - E_{t-1}}{TA_t}, \tag{4.4}$$

where E_t and E_{t-1} are the earnings before extraordinary items in year t and year t-1 relative to dividend change year (t=0); and TA_t is the book value of total assets in year t.

c) ROA change (ΔROA_t)

As another measure of firm's profitability, ROA change is defined as

$$\Delta ROA_t = ROA_t - ROA_{t-1}, \tag{4.5}$$

where ROA_t and ROA_{t-1} are returns on assets in year t and year t-1 relative to dividend change year (t=0), and ROA is defined as operating income over book value of total assets.

d) Firm size (*SIZE*)

The natural logarithm of book value of total assets is used as a proxy for firm size.

$$SIZE = Ln\ (BV\ Total\ Assets). \qquad (4.6)$$

e) Market-to-book ratio (*MTB*)

Following Fama and French (2001), market-to-book ratio is used as a proxy for firm's future investment opportunities.

$$MTB = \left(\frac{TA - BVE + MVE}{TA} \right) \qquad (4.7)$$

where *TA* is the book value of total assets, *BVE* is the book value of equity, and *MVE* is the market value of equity.

f) Cash flow (*CF*)

Following Lehn and Poulsen (1989) and Denis et al. (1994), cash flow is defined as follows

CF = (Operating income before depreciation - interest expenses - taxes - preferred dividends - common dividends)/ Book value of total assets. (4.8)

g) Retained earnings to book value of equity (*RTE*)

According to DeAngelo et al (2006) and Denis and Osobov (2008), retained earnings to book value of equity (*RTE*), a measure of equity capital that is earned from the firm's earnings performance rather than contributed by shareholders, is a significant factor affecting firm's dividend policy. Therefore, I wish to test its significance on dividend policy in Thailand.

$$RTE = Retained\ earnings/Book\ value\ of\ equity. \tag{4.9}$$

h) Debt ratio (*DTA*)

The debt ratio is predicted to have a negative relation with dividend changes. It is defined as

$$DTA = Book\ value\ of\ total\ debt/Book\ value\ of\ total\ assets. \tag{4.10}$$

i) Dividend yield (*YLD*)

To test the dividend clientele hypothesis, the past dividend yield is used as a proxy for investors' anticipated yield.

$$YLD = Dividends\ in\ year\ \text{-}1/MV\ of\ equity\ at\ the\ end\ of\ year\ \text{-}1 \tag{4.11}$$

j) Change in capital expenditures ($\Delta CAPEX_t$)

Change in capital expenditures ($\Delta CAPEX_t$) is used to investigate the firm's investment behaviours following dividend changes.

$$\Delta CAPEX_t = \frac{CAPEX_t - CAPEX_{t-1}}{TA_t}, \tag{4.12}$$

where $CAPEX$ is purchase of fixed assets plus purchase of investments; and TA_t is the book value of total assets in year t.

Table 4.1 shows the descriptive statistics of the sample firms in dividend-change year (year 0). It reveals that dividend increases are more frequent and of greater magnitude than dividend decreases in both the mean and the median values. The tests of differences in means and medians in Panel C indicate that, compared with dividend-decreasing firms, dividend-increasing firms are much larger, more profitable, and have higher cash flows. According to the free cash flow hypothesis, these characteristics suggest that dividend-increasing firms are more likely to be overinvestors than dividend-decreasing firms.

In addition, results in Panel C show that the past dividends yield of dividend-increasing firms is significantly lower than that of dividend-decreasing firms. This might suggest that high-yield firms are less likely to increase dividends. However, the tests of significance do not indicate differences in growth opportunities, as measured by market-to-book ratio (MTB), retained earnings to total equity (RTE), and debt ratio (DTA) between these two groups.

Table 4.1 Descriptive statistics of variables in the dividend-change year

	Mean	Median	Std.	Min.	Max.
Panel A: Dividend Increase (n = 206)					
Size of increase	82.53%	50.00%	90.82%	10%	500%
Total Assets (Mil. Baht)	20,551	4,289	65,036	242	649,807
Earnings/TA	0.1090	0.0869	0.1629	-0.1147	2.2896
ROA	0.1278	0.1172	0.0663	0.0220	0.4490
MTB	1.3067	1.1920	0.6365	0.1761	4.9065
CF/TA	0.0880	0.0887	0.1135	-0.4174	0.9459
RTE	0.4002	0.3917	0.2049	0.0217	0.9965
DTA	0.3765	0.3879	0.1961	0.0044	0.7809
YLD	0.0447	0.0433	0.0214	0.0018	0.1191
Panel B: Dividend Decrease (n = 114)					
Size of decrease	38.68%	33.33%	21.58%	10%	100%
Total Assets (Mil. Baht)	7,989	2,238	23,746	250	231,638
Earnings/TA	0.0894	0.0757	0.0627	0.0082	0.3197
ROA	0.1092	0.0935	0.0686	0.0052	0.3120
MTB	1.4298	1.2329	0.7660	0.4098	6.7130
CF/TA	0.0238	0.0290	0.1142	-0.3074	0.4548
RTE	0.3825	0.3945	0.2258	0.0152	0.9298
DTA	0.3441	0.3162	0.2185	0.0312	1.2775
YLD	0.0788	0.0743	0.0360	0.0050	0.2468
Panel C: Test of Difference (Dividend Increase – Dividend Decrease)					
	Mean	**Median**		***t*-statistic**	**z-statistic**
Total Assets (Mil. Baht)	12,562*	2,051**		2.489	-2.725
Earnings/TA	0.0196	0.0112*		1.236	-2.391
ROA	0.0186*	0.0237**		2.380	-2.879
MTB	-0.1231	-0.0409		-1.540	-1.584
CF/TA	0.0642**	0.0597**		4.831	-5.786
RTE	0.0177	-0.0028		0.712	-0.777
DTA	0.0324	0.0717		1.356	-1.600
YLD	-0.0341**	-0.0310**		-9.244	-9.190

**, * indicate statistical significance at the 0.01 and 0.05 levels, respectively, using two-tailed *t*-test for the means and Wilcoxon *z*-test for the medians.

4.4 Empirical Results

4.4.1 Profitability around Dividend Changes

4.4.1.1 Earnings Changes around Dividend Changes

An implication of the signalling hypothesis is that subsequent earnings performance of dividend increasing (decreasing) firms should be higher (lower) than that of dividend-unchanged firms. Under the underlying assumption that earnings changes follow random walks, I begin the analysis of the signalling hypothesis by examining the earnings performance of dividend-changing firms in Thailand in years -1, year 0 (dividend-change year), year 1, and year 2 as Fukuda (2000) did in Japan.

Panel A of Table 4.2a indicates that dividend-increasing firms perform well in one year before the dividend increases and in concurrent year, with significantly positive earnings growths of 2.30% and 2.28% respectively. However, their earnings growth declines to only 0.82% in one year after dividend increases and becomes negative at -0.09% in two years after dividend increases. For dividend-decreasing firms, the results show that they perform poorly in one year prior to dividend decreases, with a significantly negative earnings growth of -0.97%. In the event year and each of the two years following dividend decreases, however, I do not find any significant decline in earnings growth of dividend-decreasing firms.

Table 4.2a Earnings Changes Around Dividend Changes

This table reports earnings changes of the sample firms around dividend changes. Earnings changes in year t is defined as earnings in year t minus earnings in year t-1 standardized by book value of total assets at the end of year t. Panel A reports the raw earnings changes of dividend-changing firms. Panel B reports the industry-adjusted abnormal earnings changes calculated as the earnings changes of dividend-changing firms minus the earnings changes of firms in the same industry that did not change dividends in year 0. Panel C reports the abnormal earnings changes calculated as the earnings changes of dividend changing firms less the earnings changes of dividend unchanged firms that have earnings changes in year 0 within the 20% range below and above the mean earnings change of respective dividend changing firms in year 0. The figures in parentheses are the *t*-statistics for the means. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

	Year -1	**Year 0**	**Year 1**	**Year 2**
Panel A: Earnings changes standardised by book value of total assets (%)				
Increases (n = 206)	2.30***	2.28**	0.82*	-0.09
	(6.473)	(2.366)	(1.820)	(-0.173)
Decreases (n = 114)	-0.97*	-0.05	0.48	-1.05
	(-1.842)	(-0.100)	(1.212)	(-1.513)
Panel B: Earning changes of dividend changing firms less earning changes of firms in the same industry that did not change dividends (%)				
Increases (n = 206)	2.31***	1.46	0.19	-0.31
	(6.085)	(1.443)	(0.405)	(-0.576)
Decreases (n = 114)	-0.68*	-0.30	-0.47	-1.18*
	(-1.896)	(-1.272)	(-0.729)	(-1.662)
Panel C: Earnings changes of dividend changing firms less earnings changes of firms that have similar earnings growths in year 0 but did not change dividends (%)				
Increases (n = 206)	2.07***	0.18	-0.19	0.36
	(5.810)	(0.183)	(-0.415)	(0.687)
Decreases (n = 114)	0.169	-0.003	0.353	-2.73***
	(0.321)	(-0.006)	(0.889)	(-3.939)

Panel B of Table 4.2a shows the earnings performance of dividend-changing firms adjusted for the earnings performance of firms that did not change dividends in year 0 in the same industry. I find that dividend-increasing firms significantly outperform dividend-unchanged firms in one year before dividend announcements but show no superior earnings performance in concurrent year and each of the two years following dividend increases. For dividend-decreasing firms, the result indicates that they significantly underperform dividend-unchanged firms in one year before and the two years after dividend decreases.

To better detect the firm's abnormal performance, Barber and Lyon (1996) recommend that sample firms be benchmarked with control firms that have similar performance. Accordingly, the abnormal earnings performance in Panel C of Table 4.2a is calculated as the earnings changes of dividend-changing firms less the earnings changes of firms that experienced similar earnings growth in year 0 but did not change dividends. In particular, the dividend-unchanged firms are specified to have earnings growth in year 0 between 80% and 120% of the mean earnings growth in year 0 of respective dividend-changing firms.

Panel C of Table 4.2a demonstrates that dividend-increasing firms outperform control firms in one year before dividend increases but show no superior earnings performance in concurrent year and subsequent years. For dividend-decreasing firms, I find that they significantly underperform control firms in the two years after dividend decreases.

Overall, the findings from Table 4.2a provide only a little support to signalling hypothesis. The only conclusion that can be drawn from Table 4.2a is that firms increase dividends to signal the past rather than the future earnings performance, as indicated by highly significant and robust results in all three panels.

4.4.1.2 ROA changes around Dividend Changes

To check robustness of the results in previous section, I use return on assets (ROA) as alternative measure of firm's profitability. If the signalling theory is supported, one should observe a significant change in ROA following a dividend change in same direction. In addition, subsequent ROA changes of dividend-increasing (decreasing) firms should be higher (lower) than those of firms that did not change dividends.

Panel A of Table 4.2b shows that ROA of dividend-increasing firms significantly increases in one year prior to and in the year of dividend increases. However, their ROA significantly declines in each of the two years following dividend increases, a finding in contrast with the signalling hypothesis. For dividend-decreasing firms, the results indicate that their ROA declines significantly in one year before, in the year of dividend decrease announcements, and in the two years following dividend decreases, a finding consistent with the signalling hypothesis.

In contrast with the signalling hypothesis, results from Panel B indicate that average industry-adjusted ROA change of dividend-increasing firms becomes significantly negative in one year following dividend increases although it is significantly and substantially positive in one year before dividend increases. For dividend-decreasing firms, I do not find any significant industry-adjusted ROA change in every year of the sample period.

Panel C shows that average ROA change of dividend-increasing firms is significantly higher than that of control firms in one year before dividend increases, but becomes significantly lower in one year following dividend increase, a finding inconsistent with the signalling hypothesis. Nevertheless, consistent with the signalling hypothesis, average ROA change of dividend-decreasing firms is significantly negative in each of the two years following dividend decreases.

Table 4.2b ROA Changes Around Dividend Changes

This table reports changes in return on assets (ROA) of the sample firms around dividend changes. ROA changes in year t is defined as ROA in year t minus ROA in year t-1, where ROA is calculated as earnings before interest and taxes, standardized by book value of total assets. Panel A reports the unadjusted ROA changes of dividend-changing firms. Panel B reports the industry-adjusted abnormal ROA changes calculated as the ROA changes of dividend-changing firms minus the ROA changes of firms in the same industry that did not change dividends in year 0. Panel C reports the abnormal ROA changes calculated as the ROA changes of dividend changing firms less the ROA changes of dividend-unchanged firms that have ROA changes in year 0 within the 20% range below and above the mean earnings change of respective dividend changing firms in year 0. The figures in parentheses are the *t*-statistics for the means. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

	Year -1	**Year 0**	**Year +1**	**Year +2**
Panel A: ROA changes (%)				
Increases (n = 206)	2.13***	0.71**	-0.62**	-0.73***
	(7.330)	(2.259)	(-2.204)	(-2.665)
Decreases (n = 114)	-2.06***	-1.13**	-0.57	-1.50**
	(-3.886)	(-2.016)	(-1.073)	(-2.076)
Panel B: ROA changes of dividend-changing firms less ROA changes of firms in the same industry that did not change dividends (%)				
Increases (n = 206)	34.58***	-3.57	-15.04***	0.33
	(7.525)	(-0.727)	(-5.469)	(0.083)
Decreases (n = 114)	-0.12	-0.43	3.02	-11.18
	(-0.023)	(-0.051)	(0.414)	(-1.355)
Panel C: ROA changes of dividend changing firms less ROA changes of firms that have similar ROA changes in year 0 but did not change dividends (%)				
Increases (n = 206)	1.92***	-0.06	-0.79***	0.08
	(6.585)	(-0.201)	(-2.783)	(0.291)
Decreases (n = 114)	-0.44	-0.21	-1.04**	-4.27***
	(-0.834)	(-0.215)	(-1.978)	(-5.913)

Overall, the findings from Table 4.2b for dividend-increasing firms show no evidence in support of the signalling hypothesis. That is, profitability does not significantly improve but deteriorate following dividend increases. Although the findings for dividend-decreasing firms lend support to the signalling hypothesis, i.e., profitability falls significantly after dividend decreases, the results are not robust in all three panels.

4.4.2 Dividend Changes and Future Earnings Changes

In this section, the relation between dividend changes and earnings changes is formally investigated. Adopting an approach similar to the one used in Benartzi et al. (1997), I start with the examination of the correlation between the change in dividend in year 0 and the change in earnings in years 1 and 2.

$$\Delta E_t = a + b\Delta DIV_0 + \varepsilon_t , \tag{4.13}$$

for t = 1 and 2, where ΔE_t denotes change in earnings before extraordinary items from year t-1 to year t standardized by book value of total assets in year t, and ΔDIV_0 is the annualized dividend change between year -1 and year 0.

Table 4.3 reports the regression result of equation (4.13). It indicates a significant positive relation between dividend changes and earnings changes in one year following dividend changes but insignificant negative relation between these variables in two years after dividend changes. Thus, the results from Table 4.3 lend only a little support to the signalling theory.

Table 4.3 Dividend Changes and Future Earnings Changes

This table reports regression results between dividend changes and future earnings changes. ΔE_t denotes earnings growth between year t-1 and year t, standardized by book value of total assets in year t. ΔDIV_0 is the annual dividend change (%) from year -1 to year 0. The figures in parentheses are the *t*-statistics for the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta E_t = a + b\Delta DIV_0 + \varepsilon_t$			
t	*a*	*b*	R^2
1	0.004	0.008*	1.7%
	(1.098)	(2.373)	
2	-0.002	-0.006	0.2%
	(-0.452)	(-1.315)	

4.4.3 Dividend Changes and Future ROA Changes

As a robustness check of whether dividend changes signal future profitability, the dependent variable in equation 4.13 is replaced with the ROA changes.

$$\Delta ROA_t = a + b\Delta DIV_0 + \varepsilon_t, \tag{4.14}$$

for t = 1 and 2, where ΔROA_t denotes change in return on assets between year t-1 and year t, ROA_t is the earnings before interest and tax scaled by book value of total assets value of total assets at the beginning of the year, and ΔDIV_0 is the annualized dividend change between year -1 and year 0.

The results from Table 4.4 show no indication in support of the signalling hypothesis.[17] In particular, a significantly negative relation between dividend change and ROA change is found in one year after dividend announcement, a finding against

[17] Using change in return on equity (ΔROE_t) or change in return on sales (ΔROS_t) as dependent variable yields similar results.

the signalling hypothesis, and no significant relation between dividend change and ROA change is found in two years after dividend announcement

Table 4.4 Dividend Changes and Future ROA Changes

This table reports regression results between dividend changes and future ROA changes. ΔROA_t denotes change in return on assets between year t-1 and year t, where ROA_t is the earnings before interest and tax scaled by book value of total assets. ΔDIV_0 is the annual dividend change (%) from year -1 to year 0. The figures in parentheses are the *t*-statistics for the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta ROA_t = a + b\Delta DIV_0 + \varepsilon_t$			
t	*a*	*b*	R^2
1	0.065**	-0.056**	1.0%
	(2.110)	(-1.833)	
2	-0.033	0.038	0.3%
	(-0.854)	(1.003)	

4.4.4 Dividend Changes and Past Earnings Changes

In previous sections, I have found only a little indication that dividend changes signal changes in profitability in the same direction. Perhaps, the manager's decision to change dividends is a lagged result of past performance. Therefore, in this section, the other side of the story is explored by examining the relation between dividend changes and past earnings changes. The dependent variable now is the dividend change in year 0, and the explanatory variable is the earnings change in year -1.

$$\Delta DIV_0 = a + b\Delta E_{-1} + \varepsilon \,, \qquad (4.15)$$

where ΔDIV_0 is the percentage change in dividends from year -1 to year 0; ΔE_{-1} denotes the earnings changes from year -2 to -1.

Table 4.5 demonstrates that the relations between dividend changes and the past earnings changes is positive and highly significant at 1% level. Thus, the past earnings change is a significant determinant of dividend change.

Table 4.5 Dividend Changes and Past Earnings Changes

This table reports regression results between dividend changes and the past earnings changes. ΔDIV_0 is the percentage change in dividends from year -1 to year 0. ΔE_{-1} denotes the percentage changes in earnings from year -2 to -1. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta DIV_0 = a + b\Delta E_{-1} + \varepsilon$		
a	*b*	R^2
0.358*** (6.775)	3.125*** (3.323)	3.7%

4.4.5 Dividend Changes and Past ROA Changes

In this section, I test whether the past change in profitability, as measured by ROA, is a significant determinant of dividend change.

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + \varepsilon \,, \tag{4.16}$$

where ΔDIV_0 is the percentage change in dividend from year -1 to year 0; ΔROA_{-1} denotes the ROA changes from year -2 to -1.

Table 4.6 Dividend Changes and Past ROA Changes

This table reports regression results between dividend changes and the past ROA changes. ΔDIV_0 is the percentage change in dividends from year -1 to year 0. ΔROA_{-1} denotes the changes in ROA from year -2 to -1. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta DIV_0 = a + b\Delta ROA_{-1} + \varepsilon$		
a	*b*	R^2
0.319*** (6.775)	0.530*** (6.546)	11.9%

The results from Table 4.6 reveal that past ROA change is a highly significant factor of dividend change. Compared with past earnings change, past ROA change appears to be a better explanatory variable of dividend change in Thailand as indicated by higher R^2. Therefore, ROA change will be used as a measure of firm's profitability henceforth.

4.4.6 Dividend Changes and Firm Size

According to the signalling hypothesis, larger firms have fewer needs to signal their prospects to shareholders through dividends than smaller firms because larger firms tend to have more information available to public. Therefore, the signalling hypothesis predicts a negative relation between dividend change and firm size. On the other hand, the free cash flow hypothesis stipulates that larger firms are more mature than smaller firms and tend to pay higher dividends. Thus, the free cash flow hypothesis predicts a positive relation between dividend change and firm size.

To examine whether firm size has a significant impact on dividend policy in Thailand, I perform the following regression with past ROA change as control variable.

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + cSIZE + \varepsilon, \tag{4.17}$$

where ΔDIV_0 is the percentage change in dividends from year -1 to year 0; ΔROA_{-1} denotes the ROA changes from year -2 to -1 ; and $SIZE$ is the natural logarithm of book value of total assets measured at the beginning of year 0.

The result from Table 4.7 indicates that there is a significantly positive relation between firm size and dividend change, a finding consistent with the free cash flow hypothesis.

Table 4.7 Dividend Changes and Firm Size

This table reports regression results between dividend changes and firm size, controlling for the past ROA change. ΔDIV_0 is the percentage change in dividends from year -1 to year 0. ΔROA_{-1} denotes the ROA changes from year -2 to -1. *SIZE* is the natural logarithm of book value of total assets. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

a	*b*	*c*	*Adjusted* R^2
-0.758	0.533***	0.071**	12.6%
(-1.873)	(7.092)	(3.534)	

4.4.7 Dividend Changes and Investment Opportunities

According to the free cash flow hypothesis, firms with low investment opportunities tend to be overinvestors, and are more likely to increase dividends to signal that corporate cash flows will not be wastefully invested in negative NPV projects. On the other hand, firms with high investments opportunities are less likely to increase dividends because they want to preserve cash to finance their growth. Hence, the free cash flow hypothesis predicts a negative relation between the magnitude of dividend change and investment opportunities.

To test this prediction, I run regression between dividend change and market-to-book ratio, which is a proxy for investment opportunities.

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + cMTB + \varepsilon \, , \qquad (4.18)$$

where ΔDIV_0 and ΔROA_{-1} are defined as before; *MTB* is the market-to-book ratio of assets measured at the beginning of year 0.

Table 4.8 Dividend Changes and Investment Opportunities

This table reports regression results between dividend changes and investment opportunities, controlling for the past ROA change. ΔDIV_0 is the percentage change in dividends from year -1 to year 0. ΔROA_{-1} denotes the ROA changes from year -2 to -1. *MTB* is the market-to-book ratio of assets. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta DIV_0 = a + b\Delta ROA_{-1} + cMTB + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
0.461***	0.539***	-0.106	11.9%
(4.226)	(6.644)	(-1.469)	

The results from Table 4.8 indicate that, controlling for the past ROA change, there is no significant relation between magnitude of dividend change and investment opportunities.

4.4.8 Dividend Changes and Cash Flows

In this section, I examine whether the magnitude of dividend change is significantly related to cash flow. The free cash flow hypothesis predicts a positive relation between dividend change and cash flow, positing that firms with high cash flows are more likely to raise dividend than firms with low cash flows.

To determine the relation between cash flow and dividend change, I run the following regression

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + cCF + \varepsilon\,, \qquad (4.19)$$

where ΔDIV_0 and ΔROA_{-1} are defined as before; CF is the operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends, all scaled by book value of total assets.

Results from Panel A of Table 4.9 reveal that, controlling for the past and concurrent ROA changes, cash flow has a significantly positive relation with the size of dividend changes, a finding consistent with the free cash flow hypothesis. However, results from separate regressions in Panel B and C show no significant relation between cash flow and the size of dividend increases and decreases.

Table 4.9 Dividend Changes and Cash Flows

This table reports regression results between dividend changes and cash flows, controlling for the past ROA changes. ΔDIV_0 is the percentage change in dividend from year -1 to year 0; ΔROA_{-1} denotes the ROA changes from year -2 to -1; CF is the operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends, all scaled by book value of total assets. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta DIV_0 = a + b\Delta ROA_{-1} + cCF + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
0.253*** (4.226)	0.504*** (6.644)	1.066** (-1.469)	13.1%

4.4.9 Dividend Changes and Earned Equity Changes

According to DeAngelo, DeAngelo, and Stulz (2006), the earned/contributed capital mix is a good proxy for the firm's life-cycle stage because it measures the extent to which the firm is self-financing or reliant on external capital. Firms with high retained earnings to equity tend to be more mature with high accumulated profits and self-financed, thus making them good candidates to pay dividends.

Investigating the propensity to pay dividends of U.S. firms, DeAngelo et al. find that there is a highly significant relation between the firm's decision to pay dividend and the earned/contributed capital mix, controlling for profitability, growth, firm size, total equity, cash balances, and dividend history. This relation also holds for dividend initiations and omissions. Likewise, Denis and Osobov (2008) recently document that the earned/contributed capital mix is a significant determinant of the propensity to pay dividends in all six countries of their study.

Accordingly, I hypothesise that the earned/contributed capital mix should also have a significant relation with dividend changes in Thailand. More precisely, I predict a positive relation between the change[18] in earned/contributed capital mix, measured by the change in retained earnings to book value of equity (ΔRTE), and dividend changes. To test such a prediction, the following regression is performed

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + c\Delta RTE_{-1} + \varepsilon , \qquad (4.20)$$

where ΔDIV_0 and ΔROA_{-1} are defined as before; ΔRTE_{-1} is the change in retained earnings to book value of equity from year -2 to year -1.

Table 4.10a shows that the past RTE change is a significantly positive factor of dividend changes, the results consistent with the life-cycle theory of dividends and the free cash flow hypothesis.

[18] While the *level* of earned/contributed capital mix is a significant factor explaining firm's decision to *pay or not to pay* dividends, the *change* in earned/contributed capital mix is used here to test whether it is a significant factor explaining firm's decision to *change* dividends.

Table 4.10a Dividend Changes and RTE Changes

This table reports regression results between dividend changes and RTE changes, controlling for the past ROA changes. ΔDIV_0 is the percentage change in dividends from year -1 to year 0. ΔROA_{-1} denotes the changes in ROA from year -2 to -1. ΔRTE_{-1} is the change in retained earnings to book value of equity from year -2 to year -1. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta DIV_0 = a + b\Delta ROA_{-1} + c\Delta RTE_{-1} + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
0.261***	0.446***	1.483***	17.7%
(5.179)	(5.571)	(4.937)	

As a robustness check, I employ an alternative measure of earned equity change, change in retained earnings to total assets (ΔRTA), and test its significance by running the following regression.

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + c\Delta RTA_{-1} + \varepsilon, \qquad (4.21)$$

where ΔDIV_0 and ΔROA_{-1} are defined as before; ΔRTA_{-1} is the change in retained earnings to book value of assets from year -2 to year -1.

Table 4.10b Dividend Changes and RTA Changes

This table reports regression results between dividend changes and RTA changes, controlling for the past ROA changes. ΔDIV_0 is the percentage change in dividends from year -1 to year 0. ΔROA_{-1} denotes the changes in ROA from year -2 to -1. ΔRTA_{-1} is the change in retained earnings to book value of assets from year -2 to year -1. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta DIV_0 = a + b\Delta ROA_{-1} + c\Delta RTA_{-1} + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
0.241***	0.437***	3.960***	17.7%
(4.681)	(5.431)	(4.931)	

Table 4.10b shows very similar results to those in Table 4.10a. Controlling for the past ROA changes, the past RTA change has a highly significant relation with dividend changes in the same direction, the findings in line with the life-cycle theory of dividends and, to some extent, the free cash flow hypothesis. Therefore, the robust results ensure that earned equity change is a significant determinant of dividend changes in Thailand.

4.4.10 Dividend Changes and Debt Ratio

In this section, I examine whether debt ratio, measured as total debt to total assets, has a significant relation with magnitude of dividend change. Since firms with high debt ratio are more likely to be financially constrained and thus should have less ability to raise dividends, I predict a negative relation between debt ratio and magnitude of dividend change. To test such a prediction, the following regression is performed

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + cDTA + \varepsilon \,, \qquad (4.22)$$

where ΔDIV_0 and ΔROA_{-1} are defined as before. DTA is total debt to book value of total assets at the end of year -1.

Table 4.11 Dividend Changes and Debt Ratio

This table reports regression results between dividend change and debt ratio, controlling for the past ROA changes. ΔDIV_0 is the percentage change in dividend from year -1 to year 0. ΔROA_{-1} and ΔROA_0 denote the changes in ROA from year -2 to -1 and from year -1 to year 0 respectively. *DTA* is total debt to book value of total assets at the end of year -1. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$\Delta DIV_0 = a + b\Delta ROA_{-1} + cDTA + \varepsilon$			
a	*b*	*c*	*Adjusted R^2*
0.112* (1.703)	0.549*** (6.996)	0.532*** (4.755)	17.2%

In contrary to the prediction, the result from Table 4.11 indicates a highly significant positive relation between debt ratio and magnitude of dividend change, controlling for the past ROA changes. A possible explanation for this finding is that dividend increases in Thailand are financed with debt. However, this issue is beyond the scope of this study.

4.4.11 Dividend Changes and Past Dividend Yield

In this section, I introduce past dividend yield as a potential explanatory variable of dividend change in Thailand. As indicated by survey results of Lintner (1956), management has a strong desire to maintain the stability of dividends, implying that high yield firms are less likely to raise dividends than low yield firms. Thus, I expect a negative relation between past dividend yield and magnitude of dividend change. To test this prediction, the following regression is performed

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + cYLD_{-1} + \varepsilon, \qquad (4.23)$$

where ΔDIV_0 and ΔROA_{-1} are defined as before; YLD is dividend payments in year -1 divided by market value of equity at the end of year -1.

Table 4.12 Dividend Changes and Past Dividend Yield

This table reports regression results between dividend change and debt ratio, controlling for the past ROA change. ΔDIV_0 is the percentage change in dividend from year -1 to year 0. ΔROA_{-1} denotes the change in ROA from year -2 to -1. YLD_{-1} is dividend payments in year -1 divided by market value of equity at the end of year -1. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$$\Delta DIV_0 = a + b\Delta ROA_{-1} + cYLD_{-1} + \varepsilon$$

a	*b*	*c*	*Adjusted R^2*
1.079***	0.328***	-12.864***	28.8%
(11.085)	(4.304)	(-8.832)	

The result from Table 4.12 shows that past dividend yield has a highly significant negative relation with dividend changes. Dividend changes in Thailand are largely determined by the past dividend yield as indicated by a high adjusted R^2 of 28.8%.

4.4.12 Determinants of Magnitude of Dividend Changes

Having analysed the impact of each variable on magnitude of dividend changes in previous sections, the multiple regressions are performed between dividend change and potential independent variables, i.e., the past ROA change, firm size, market-to-book ratio, cash flow, earned equity change, debt ratio, and past dividend yield. The results from Table 4.13 reveal that the past ROA change is a significantly positive determinant of the magnitude of dividend changes. Model (1) indicates that firm size has a significantly positive relation with the magnitude of dividend change, controlling for the past ROA change, market-to-book ratio, and cash flow. Thus, this finding lends support to the free cash flow hypothesis. Both model (1) and model (2) show a negative relation between MTB and magnitude of dividend changes, the results consistent with the signalling hypothesis. In addition, Model (1) indicates that, controlling for the past ROA change, firm size, and MTB, cash flow has a significantly positive relation with the size of dividend change, a finding consistent with the free cash flow hypothesis.

Further, I find that the past change in earned equity has a significantly positive relation with the magnitude of dividend changes, a finding consistent with the life-cycle theory of dividends. The results also indicate that debt ratio has a positive effect whereas dividend yield has a negative effect on the magnitude of dividend changes. Overall, I find that past profitability, firm size, cash flow, past RTE change, and debt ratio are positive factors while MTB and past dividend yield are negative factors of magnitude of dividend changes in Thailand.

Table 4.13 Determinants of Magnitude of Dividend Changes

This table reports multiple regression results between dividend change and hypothesised explanatory variables. ΔROA_{-1} denotes ROA change from year -2 to -1. *SIZE* is the natural logarithm of book value of total assets. *MTB* is market-to-book value of assets at the end of year -1. *CF* is the operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends, all scaled by book value of total assets. ΔRTE_{-1} is the change in retained earnings to book value of equity from year -2 to year -1. *DTA* is the total debt to book value of total assets. YLD_{-1} is dividend payments over market value of equity in year -1. The figures in parentheses are the *t*-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

Variable	Model (1)	Model (2)
Intercept	-0.807	0.989**
	(-1.623)	(2.056)
ΔROA_{-1}	0.519***	0.327***
	(6.459)	(4.931)
SIZE	0.084**	0.004
	(2.508)	(0.121)
MTB	-0.159**	-0.199***
	(-2.182)	(-3.091)
CF	1.089***	0.095
	(2.611)	(0.249)
ΔRTE_{-1}		1.015***
		(3.619)
DTA		0.346***
		(3.337)
YLD_{-1}		-10.844***
		(-7.029)
Adjusted R^2	15.0%	34.6%

4.4.13 Logit Analysis of Firm's Decision to Change Dividends

In this section, I further examine the factors that have significant influences on firm's decision to increase or decrease dividends (or keep dividends unchanged). Specifically, I run the logit regressions for dividend increases and decreases with all the same independent variables in section 4.4.12.

The logit[19] regression results in Table 4.14 reveal that the past ROA change has a significantly positive impact on firm's decision to increase dividends. That is, the higher the past ROA change, the higher the probability that firms raise dividends. On the other hand, the past ROA change has a significantly negative impact on the firm's decision to cut dividends. That is, the higher the past ROA change, the lower the probability that firms cut dividends.

Controlling for the past ROA change, firm size has a significant relation with the firm's decision to increase and decrease dividends. Specifically, larger firms are more likely to increase dividends while smaller firms are more likely to decrease dividends, the findings consistent with the free cash flow hypothesis. The results also show that firms with higher market-to-book ratio are less likely to raise dividends and more likely to cut dividends. These findings are consistent with the life-cycle theory of dividends proposed by DeAngelo, DeAngelo, and Stulz (2006) that firms in a growth phase with abundant investment opportunities are more likely to cut dividends to maintain their growth rate. Additionally, I find that firms with higher cash flows are more likely to increase dividends and firms with lower cash flows are more likely to cut dividends, the findings consistent with the free cash flow hypothesis. Further, I find that a larger increase in earned equity raises (lowers) the probability that firms increase (decrease) dividends, the findings consistent with the life-cycle theory of dividends. However, I find that debt ratio is insignificant determinant of probability to change dividends by Thai firms, a finding in contrast with that reported by Aivazian, Booth, and Cleary (2006).

[19] Using a dependent variable that is binary mitigates the simultaneity problem (Schmidt and Strauss, 1975).

Finally, I find that dividend yield has a massive impact on firm's decision to change dividends, as indicated by substantial increases in pseudo R^2 in model (2) of both dividend increases and decreases. In particular, I find that the probability to increase (decrease) dividends falls (rises) with higher past dividend yield.

Table 4.14 Logit Analysis of Firm's Decision to Change Dividends

This table reports logit regression results between dividend change and potential explanatory variables. Dividend change is either dividend increase (the value = 1 but 0 otherwise) or dividend decrease (the value = 1 but 0 otherwise). ΔROA_{-1} denotes ROA changes from year -2 to -1. *SIZE* is the natural logarithm of book value of total assets. *MTB* is market-to-book value of assets. *CF* is the operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends, all scaled by book value of total assets. ΔRTE_{-1} is the change in retained earnings to book value of equity from year -2 to year -1. *DTA* is the total debt to book value of total assets at the end of year -1. YLD_{-1} is dividend payments over market value of equity in year -1. The figures in parentheses are the Wald-statistics. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

	Increases		Decreases	
Variable	(1)	(2)	(1)	(2)
Intercept	-3.572***	-0.603	3.218**	-0.135
	(9.086)	(0.196)	(5.366)	(0.007)
ΔROA_{-1}	1.617***	1.152***	-1.207***	-0.645**
	(26.859)	(14.771)	(14.087)	(4.359)
SIZE	0.241***	0.128	-0.317***	-0.219**
	(9.056)	(2.027)	(11.031)	(4.226)
MTB	-0.311*	-0.348*	0.626***	0.667***
	(3.680)	(3.480)	(13.290)	(10.878)
CF	4.457***	2.989**	-4.781***	-2.896**
	(13.692)	(5.789)	(15.561)	(4.807)
ΔRTE_{-1}		5.561***		-6.749***
		(6.888)		(7.424)
DTA		0.203		0.214
		(0.320)		(0.557)
YLD_{-1}		-24.856***		30.107***
		(22.697)		(27.846)
Pseudo R^2	22.2%	34.2%	19.5%	36.2%

4.4.14 Stock Market Reactions to Dividend Change Announcements

4.4.14.1 Short-run Stock Price Performance around Dividend Changes

One implication of the signalling hypothesis is that the unexpected dividend changes should be accompanied by stock price changes in the same direction around dividend change announcements (Allen and Michaely, 2003). In this section, I examine the stock returns surrounding dividend changes. Following DeAngelo, DeAngelo, and Skinner (1996), I use the market-adjust returns to measure the abnormal stock price reactions around dividend changes.[20] Specifically, the daily abnormal return (AR) is calculated as

$$AR_{i,t} = r_{i,t} - r_{m,t} \, , \tag{4.24}$$

where $r_{i,t}$ is the return on security *i* at date *t,* and $r_{m,t}$ is the return on the value-weighted SET index.

Subsequently, the cumulative abnormal return (CAR) is calculated as the sum of $AR_{i,t}$ during the 3-day window (-1, +1), from one day before to one day after the dividend announcement day (t=0), as following

$$CAR_i = \sum_{t=-1}^{t=1} AR_{i,t} \, . \tag{4.25}$$

The results in Panel A of Table 4.15 show that market reacts positively to dividend increases but negatively to dividend decreases, the findings broadly consistent with earlier studies in the U.S. Compared with the average abnormal return in the U.S., however, the average abnormal return to dividend increases in

[20] I do not use the market model to estimate the expected returns because many securities in the sample firms have very low liquidity, i.e., they have no trading volume for many days in the sample period.

Thailand of 2.63% (a median of 2.06%) is much larger while the average abnormal return to dividend decreases of -1.53% (a median of -0.89%) is much smaller.[21]

4.4.14.2 Long-run Stock Price Performance following Dividend Changes

I further investigate the long-run stock price performance subsequent to dividend changes to observe how the market reacts as it later discovers that earnings of dividend-increasing firms do not significantly improve and earnings of dividend-decreasing firms do not significantly decline. I use the buy-and-hold abnormal return (BHAR) adjusted by the market return to detect the abnormal stock price performance after dividend change announcements as follows

$$BHAR_i = \prod_{t=a}^{b} \left(1 + R_{it}\right) - \prod_{t=a}^{b} \left(1 + M_t\right), \tag{4.26}$$

where R_{it} is the return on stock i on month t and M_t is the return on the SET value-weighted market portfolio on month t. The BHARs for 12 months before, and 12 months and 24 months after the month in which firms announce dividend changes (month 0) are then calculated and reported in Table 4.15.

The results indicate that dividend-increasing firms outperform the market by 7.78% in 12 months prior to dividend increases. However, like Harada and Nguyen (2005), I find that the abnormal returns become negative in the long run following dividend changes. In particular, they underperform the market with a negative BHAR of -12.89% in 12 months subsequent to dividend changes and continue to perform poorly relative to the market in the longer term with a negative BHAR of -30.89% in 24 months after dividend changes. These results contradict those of Benartzi, Michaely and Thaler (1997), who find a positive drift after dividend announcements. The downward trend of abnormal returns suggests that investors are initially overly

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[21] See, e.g., Grullon, Michaely, and Swaminathan (2002) who reported the average abnormal return of 1.34% (a median of 0.95%) to dividend increases and the average abnormal return of -3.71% (a median of -2.05%) to dividend decreases in the U.S.

optimistic about firm's future prospects and overreact to dividend increase announcements, and then, over time, the market corrects firm valuations (as in DeAngelo, DeAngelo, and Skinner, 1996; Fukuda, 2000).

I find that dividend-decreasing firms experience a significantly negative abnormal return of -37.83% in 12 months before dividend decreases, and continue to perform poorly relative to the market with significantly negative returns of -24.80% and -55.27% in 12 months and 24 months following dividend decreases. The downward trend in the long-run abnormal return of dividend-decreasing firms suggests that market underreacts to bad news.

The results of an over-reaction to good news (dividend increases) and under-reaction to bad news (dividend decreases) can be considered in the framework of behavioural finance. For example, market over- and under-reaction to corporate news features in the investor-sentiment model of Barberis, Shleifer, and Vishny (1998), and the investor-overconfidence model of Daniel, Hirshleifer, and Subrahmanyam (1998).

Table 4.15 Market Reactions around Dividend Changes

This table reports the abnormal stock returns both in short-run and long-run. The immediate stock market reaction is measured by a 3-day window cumulative abnormal return from one day before to one day after the dividend change day (day 0). The abnormal market-adjusted return for each security i is defined as $AR_{i,t} = r_{i,t} - r_{m,t}$, where $r_{i,t}$ is the return on security *i* at date *t,* and $r_{m,t}$ is the return on the value-weighted SET index. BHAR -12, BHAR12 and BHAR24 are the buy-and-hold abnormal returns for 12 months before, 12 months after, and 24 months after the dividend change month (month 0) respectively. The buy-and-hold abnormal return for each security *i* is defined as $BHAR_i = \prod_{t=a}^{b}(1+R_{it}) - \prod_{t=a}^{b}(1+M_t)$, where R_{it} is the return on stock *i* on month t and M_t is the return on the SET value- weighted market portfolio on month *t*. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

	CAR (-1,+1)	BHAR -12	BHAR 12	BHAR 24
Dividend Increases (n = 206)				
Mean	2.63***	7.78	-12.89***	-30.89***
t-statistics	(8.192)	(1.383)	(-3.131)	(-5.776)
Median	2.06	3.87	-9.19	-29.63
Dividend Decreases (n = 114)				
Mean	-1.53***	-37.83***	-24.80***	-55.27***
t-statistics	(-4.465)	(-6.200)	(-5.352)	(-8.685)
Median	-0.89	-26.04	-13.63	-54.44

4.4.15 Announcement Returns and Size of Dividend Changes

A prediction of the signalling hypothesis is that greater magnitude of dividend change is accompanied by higher announcement returns in the same direction. I test this prediction by running a regression between announcement returns and magnitude of dividend change.

$$CAR = a + b\Delta DIV_0 + cDIVDUM + \varepsilon \,, \tag{4.27}$$

where CAR is the market-adjusted cumulative abnormal return during a 3-day window (-1, +1) ; ΔDIV_0 is the percentage change in dividends from year -1 to year 0; DIVDUM = 1 for dividend increase and 0 for dividend decrease.

Table 4.16 shows that the size of dividend changes has a significantly positive relation with the magnitude of announcement returns, indicating that dividend increases are perceived as good news and dividend cuts are perceived as bad news. The coefficient of dummy variable is highly significant, indicating that dividend increases and dividend decreases affect CAR differently.

Table 4.16 Announcement Returns and Size of Dividend Changes

This table reports regression results between cumulative abnormal returns (CAR) and size of dividend changes. CAR is the market-adjusted cumulative abnormal return during a 3-day window (-1, +1). ΔDIV_0 is the percentage change in dividend from year -1 to year 0. *DIVDUM* = 1 for dividend increase and 0 for dividend decrease. The figures in parentheses are the *t*-statistics for the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$$CAR = a + b\Delta DIV_0 + cDIVDUM + \varepsilon$$

a	*b*	*c*	*Adjusted R^2*
-0.013***	0.010***	0.032***	23.0%
(-3.346)	(3.308)	(5.257)	

4.4.16 Announcement Returns and Past Dividend Yield

In this section, I examine whether there is any significant relation between announcement return and past dividend yield. This provides us with an opportunity to test the dividend clientele hypothesis in Thailand. According to this hypothesis, a dividend increase will result in higher positive announcement return for high-yield firms than for low-yield firms if high-yield firms attract investors with a preference for higher dividends. Similarly, a dividend decrease will be accompanied by lower negative announcement return for low-yield firms if investors in low-yield stocks prefer lower dividend payments.

Previous studies (e.g., Bajaj and Vijh, 1990; Denis et al., 1994) document a positive relation between the magnitude of stock market reaction to a dividend change announcement and dividend yield, the finding consistent with the dividend clientele hypothesis. To examine the relation between announcement return and dividend yield in Thailand, I run the following regression

$$CAR = a + b\Delta DIV_0 + cYLD_{-1} + \varepsilon\,, \tag{4.28}$$

where CAR and DIV_0 are defined as before, and YLD_{-1} is the past dividend yield, calculated as dividends in year -1 over market value of equity at the end of year -1.

The results from Table 4.17 indicate that, controlling for the size of dividend change, dividend yield is not a significant variable explaining initial stock market reactions to dividend change announcements. Hence, this finding fails to support the dividend clientele hypothesis.

Table 4.17 Announcement Returns and Past Dividend Yield

This table reports regression results between cumulative abnormal returns (CAR) and dividend yield. CAR is the market-adjusted cumulative abnormal return during a 3-day window (-1, +1). ΔDIV_0 is the percentage change in dividend from year -1 to year 0. YLD_{-1} is the past dividend yield, calculated as dividends in year -1 over market value of equity at the end of year -1. The figures in parentheses are the *t*-statistics for the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$CAR = a + b\Delta DIV_0 + cYLD_{-1} + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
0.006 (1.019)	0.019*** (6.654)	-0.047 (-0.549)	16.4%

4.4.17 Announcement Returns and Firm Size

An implication of signalling hypothesis is that a dividend increase by larger firms should be accompanied by a lower stock market response than a dividend increase by smaller firms because information asymmetry between managers and shareholders in larger firms, which are more often followed by analysts and outsiders, is less severe than that in smaller firms. In contrast, the free cash flow hypothesis predicts that a dividend increase by larger firms should result in a higher announcement return because larger firms are more mature and more likely to be overinvestors than smaller firms and a dividend increase is a mitigation of overinvestment problem. To test these two competing hypotheses, I run the simple regression between initial market reaction and firm size, controlling for the magnitude of dividend changes as follows.

$$CAR = a + b\Delta DIV_0 + c(DIVDUM * SIZE) + \varepsilon\,, \qquad (4.29)$$

where CAR and ΔDIV_0 are defined as before; *SIZE* is the natural logarithm of book value of total assets; DIVDUM = 1 for dividend increase and 0 for dividend decrease.

Table 4.18 Announcement Returns and Firm Size

This table reports regression results between cumulative abnormal returns (CAR) and firm size, controlling for magnitude of dividend changes. CAR is the market-adjusted cumulative abnormal return during a 3-day window (-1, +1). ΔDIV_0 is the percentage change in dividend from year -1 to year 0. *DIVDUM* = 1 for dividend increase and 0 for dividend decrease. *SIZE* is the natural logarithm of book value of total assets. The figures in parentheses are the *t*-statistics for the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$CAR = a + b\Delta DIV_0 + c(DIVDUM * SIZE) + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
-0.011*** (-2.822)	0.011*** (3.733)	0.002*** (4.638)	21.6%

The result from Table 4.18 shows a significantly positive relation between CAR and interaction term DIVDUM*SIZE, indicating that a dividend increase by larger firms results in a higher announcement return. This finding is consistent with the free cash flow hypothesis.

4.4.18 Announcement Returns and Investment Opportunities

According to the free cash flow hypothesis, a dividend increase by firms with low investment opportunities is good news for shareholders because it is less likely that management will waste corporate cash in negative NPV projects. Thus, the free cash flow hypothesis predicts a negative relation between announcement returns and investment opportunities.

To examine the relationship between announcement return and firm's investment opportunities, I run the following regression

$$CAR = a + b\Delta DIV_0 + cMTB + \varepsilon \,, \qquad (4.30)$$

where CAR and ΔDIV_0 are defined as before; MTB is the market-to-book ratio of assets measured at the beginning of year 0.

Table 4.19 Announcement Returns and Investment Opportunities

This table reports regression results between cumulative abnormal returns (CAR) and investment opportunities, controlling for the size dividend changes. CAR is the market-adjusted cumulative abnormal return during a 3-day window (-1, +1). ΔDIV_0 is the percentage change in dividends from year -1 to year 0. MTB is the market-to-book ratio of assets. The figures in parentheses are the t-statistics for the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$CAR = a + b\Delta DIV_0 + cMTB + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
0.008	0.020***	-0.003	16.5%
(1.449)	(7.954)	(-0.982)	

Table 4.19 indicates that there is no significant relation between investment opportunities, as measured by MTB ratio, and announcement returns for dividend changes in Thailand.

4.4.19 Announcement Returns and Cash Flows

The free cash flow hypothesis posits that firms with high cash flows are more likely to be overinvestors than firms with low cash flows. Therefore, a dividend increase by firms with high cash flows conveys information to the market that corporate cash flows will not be wastefully invested in negative NPV projects. To test the relation between cash flow and initial market reaction, the following regression is performed

$$CAR = a + b\Delta DIV_0 + c(DIVDUM * CF) + \varepsilon, \qquad (4.31)$$

where *CF* is undistributed cash flow defined as operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends, scaled by total assets; DIVDUM = 1 for dividend increase and 0 for dividend decrease.

Table 4.20 Announcement Returns and Cash Flows

This table reports regression results between cumulative abnormal returns (CAR) and cash flows, controlling for the size dividend changes. CAR is the market-adjusted cumulative abnormal return during a 3-day window (-1, +1). ΔDIV_0 is the percentage change in dividends from year -1 to year 0. *DIVDUM* = 1 for dividend increase and 0 for dividend decrease. *CF* is undistributed cash flow defined as operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends, all scaled by book value of total assets. The figures in parentheses are the *t*-statistics for the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$CAR = a + b\Delta DIV_0 + c(DIVDUM * CF) + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
-0.001	0.018***	0.083***	19.3%
(-0.223)	(6.880)	(3.453)	

Regression result from Table 4.20 shows a significantly positive relation between CAR and interaction term DIVDUM*CF, indicating that, compared with a dividend increase by firms with lower cash flows, a dividend increase by firms with higher cash flows results in a higher announcement return. This finding is consistent with the free cash flow hypothesis.

4.4.20 Announcement Returns and Earned Equity

In this section, I use the earned equity (RTE), measured as the retained earnings to book value of equity, to test the life-cycle theory of dividends in Thailand. According to DeAngelo et al. (2006), firms with low RTE tend to be in the growth stage and reliant on external funds, whereas firms with high RTE tend to be more mature with plentiful cumulative profits that make them good candidates to pay dividends. Essentially, the life-cycle hypothesis and the free cash flow hypothesis are very similar in that they both predict that more mature and profitable firms are more likely to pay dividends than younger firms with many investment opportunities. Consequently, a dividend increase should lead to a more positive market reaction for high RTE firms than for low RTE firms. To test the life-cycle hypothesis, I run the following regression:

$$CAR = a + b\Delta DIV_0 + cRTE + \varepsilon \, , \tag{4.32}$$

where CAR and ΔDIV_0 are defined as before; RTE is earned equity measured as retained earnings to book value of equity at the end of year -1.

The result from Table 4.21 shows that, controlling for the size of dividend change, there is a highly significant positive relation between announcement returns and RTE. In other words, for an equal size of dividend change, stock market reacts more strongly to a dividend change announcement by firms with higher RTE. This finding is consistent with the life-cycle hypothesis.

Table 4.21 Announcement Returns and Earned Equity

This table reports regression results between cumulative abnormal returns (CAR) and earned equity, controlling for magnitude of dividend changes. CAR is the market-adjusted cumulative abnormal return during a 3-day window (-1, +1). ΔDIV_0 is the percentage change in dividends from year -1 to year 0. RTE is earned equity measured as retained earnings to book value of equity at the end of year -1. The figures in parentheses are the *t*-statistics for the coefficients. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

$CAR = a + b\Delta DIV_0 + cRTE + \varepsilon$			
a	*b*	*c*	*Adjusted* R^2
-0.009*	0.021***	0.030***	18.2%
(-1.771)	(8.354)	(2.736)	

4.4.21 Determinants of Announcement Returns

Having determined significance of each variable in explaining initial market reactions to dividend change announcements in previous sections, the multiple regressions are performed between announcement returns and hypothesised independent variables, i.e., dividend change, dividend yield, firm size, investment opportunities, cash flow, and earned equity[22].

Results from Model (1) of Table 4.22 show that announcement returns are significantly related to the size of dividend change. However, contrary to the findings of Fuller and Blau (2008), I find no significant relation between announcement returns and dividend yield in both models. Hence, there is no evidence in support of the dividend clientele hypothesis. In both models, the interaction term SIZE*DIVDUM is positively related to announcement returns, indicating that a dividend increase by larger firms leads to higher announcement returns. This finding is consistent with the free cash flow hypothesis. However, there is no significant

[22] I also attempted using firm's age as a proxy for firm's maturity to test the life-cycle hypothesis but found it insignificant in all regressions.

relation between MTB and announcement returns in any case. Model (2) shows that the interaction term CF*DIVDUM is significantly related to announcement returns in the same direction, indicating that a dividend increase by firms with higher cash flows leads to higher announcement returns. This finding is consistent with the free cash flow hypothesis. In addition, RTE, a proxy for firm's life-cycle, has a significantly positive relation with announcement returns, a finding consistent with the life-cycle hypothesis and, to some extent, with the free cash flow hypothesis.

Table 4.22 Determinants of Announcement Returns

This table reports regression results between cumulative abnormal returns (CAR) and potential explanatory variables. CAR is the market-adjusted cumulative abnormal return during a 3-day window (-1, +1). ΔDIV_0 is the percentage change in dividend from year -1 to year 0. YLD_{-1} is the past dividend yield, calculated as dividend payments in year -1 over market value of equity at the end of year -1. *SIZE* is the natural logarithm of book value of total assets. *MTB* is market-to-book value of assets. *CF* is undistributed cash flow calculated as operating income before depreciation minus interest expenses, taxes, preferred dividends, and common dividends, all scaled by book value of total assets. *RTE* is retained earnings to book value of equity. The figures in parentheses are the *t*-statistics. *DIVDUM* =1 for dividend increase and 0 for dividend decrease. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

	Model	
Variable	(1)	(2)
Intercept	-0.017**	-0.019*
	(-2.268)	(-1.917)
ΔDIV_0	0.012***	0.013***
	(3.850)	(3.986)
YLD_{-1}	0.083	0.067
	(0.949)	(0.768)
*SIZE*DIVDUM*	0.002***	0.002***
	(4.699)	(3.614)
MTB		-0.003
		(-0.880)
*CF*DIVDUM*		0.048*
		(1.893*)
RTE		0.020
		(1.774)
Adjusted R^2	21.6%	23.0%

4.4.22 Investments following Dividend Changes

In this section, I further examine the firm's investment behaviours following dividend changes. According to the free cash flow hypothesis, the firm's investments should decline following a dividend increase by low-growth (MTB < the mean)[23] firms. Table 4.23 provides information about change in capital expenditures of sample firms around dividend changes according to their future investment opportunities.

Table 4.23 Investments Around Dividend Changes

This table reports percentage changes in capital expenditures of the sample firms around dividend changes. The change in capital expenditure in year t $(\Delta CAPEX_t)$ is the change from year t-1 to year t scaled by book value of total assets at the end of year t, where the capital expenditure in year t is the cash used to purchase tangible fixed assets and investments. *MTB* is market-to-book ratio of assets. ***, **, and * denote significance at the 1%, 5%, and 10% level respectively.

	Year -1	**Year 0**	**Year +1**	**Year +2**
Panel A: Dividend increase				
MTB < Mean (n = 132)	2.38***	1.17*	1.53**	0.33
	(3.456)	(1.665)	(2.280)	(0.546)
MTB > Mean (n = 74)	3.23***	1.50	-0.16	3.33***
	(2.668)	(1.040)	(-0.157)	(3.071)
Difference	-0.85	-0.33	1.69	-3.00**
	(-0.656)	(-0.205)	(1.435)	(-2.425)
Panel B: Dividend decrease				
MTB < Mean (n = 74)	1.54	1.20	0.68	0.33
	(0.749)	(0.770)	(0.576)	(0.274)
MTB > Mean (n = 40)	3.45	0.47	-0.38	-0.47
	(1.023)	(0.300)	(-0.288)	(-0.394)
Difference	-1.91	0.73	1.06	0.80
	(-0.513)	(0.299)	(0.564)	(0.428)

[23] Using MTB less than the median yields similar results.

For dividend-increasing group, Panel A shows that low-growth firms significantly increase their capital expenditures by 2.38% in one year prior to dividend increases. Then, their investment growth declines to 1.17% in the event year. In contrast with the free cash flow hypothesis, these firms increase capital expenditures significantly by 1.53% in one year following dividend increases. In the two years following dividend increases, their capital expenditures increase insignificantly by 0.33%. In addition, Panel A shows that high-growth firms significantly increase their capital expenditures by 3.23% in one year before dividend increases. However, there is no significant change in capital expenditures in the event year and one year following dividend increases. Their capital expenditures significantly increase again by 3.33% in the two years following dividend increases. Further, Panel A indicates that investment growth of high-growth firms is 3% significantly higher than that of low-growth firms in the two years following dividend increases.

For dividend-decreasing group, Panel B shows no significant investment growth for both low-growth firms and high-growth firms in the sample period. The results for dividend-decreasing group reveal that there is no statistically significant difference in investment behaviours between low-growth firms and high-growth firms.

4.4.23 Dividend Changes and Future Investments

In previous section, I find that low-growth firms do not decrease their capital expenditures following a dividend increase as predicted by the free cash flow hypothesis. In contrary, they significantly increase investments in one year following dividend increase announcements. However, it does not mean that a dividend increase does not help curtail investments and thus mitigate overinvestment problem. If a dividend increase indeed helps alleviate the agency cost of free cash flow, the size of dividend increases should have a negative impact on future investments.

An implication of the free cash flow hypothesis is that larger firms are more mature, have more free cash flow, and are more likely to be overinvestors than smaller firms. Thus, if dividend policy is adopted to control overinvestment problem, firm size may have a negative effect on subsequent investments. Cash flow change is used to test the free cash flow hypothesis that firms with more free cash flows are more likely to overinvest. Since higher MTB imply more investment opportunities, the relation between MTB ratio and capital expenditures are likely to be positive if the signalling hypothesis is supported. On the other hand, the negative relation between these two variables is consistent with the free cash flow hypothesis. To test these predictions, I adopt the following model for t =1 and 2.

$$\Delta CAPEX_t = a + b\Delta DIV_0 + cDIVDUM + d\Delta CF_{t-1} + eSIZE_{t-1} + fMTB_{t-1} + \varepsilon_t \quad (4.34)$$

where $\Delta CAPEX_t$ is the change in capital expenditure from year t-1 to year t scaled by total assets at the end of year t, where the capital expenditure in year t is the cash used to purchase tangible fixed assets and investments.

Table 4.24 shows that the magnitude of dividend change has a significantly negative impact on investments in one year following dividend announcements, a finding consistent with the free cash flow hypothesis. However, there is no significant relation between the magnitude of dividend change and investment growth in two years following dividend change announcements. The dummy variable of dividend change is statistically significant, indicating different effect between dividend increase and dividend decrease on investment growth in one year following dividend change announcements. The past cash flow change is insignificant impact on investment growth. Firm size has negative relation with investment growth in one year following dividend changes, a finding in support of the free cash flow hypothesis. However, there is no significant relation between market-to-book ratio and subsequent investment growth in any case.

Table 4.24 Investments following Dividend Changes

This table reports regression results between changes in capital expenditures and dividend changes, cash flow changes, firm size, and investment opportunities. $\Delta CAPEX_t$ is the change in capital expenditure from year t-1 to year t scaled by book value of total assets at the end of year t. ΔCF_t is the change in undistributed cash flow from year t-1 to year t scaled by book value of total assets at the end of year t. ΔDIV_0 is the annual dividend change (%) from year -1 to year 0. *DIVDUM* =1 for dividend increase and 0 for dividend decrease *SIZE* is the natural logarithm of total assets. *MTB* is the market-to-book ratio of assets. The figures in the parentheses are the *t*-statistics for the coefficients. ***, ** and * indicate statistical significance at the 0.01, 0.05 and 0.1 levels, respectively.

$$\Delta CAPEX_t = a + b\Delta DIV_0 + cDIVDUM + d\Delta CF_{t-1} + eSIZE_{t-1} + fMTB_{t-1} + \varepsilon_t$$

Coefficient	t = 1	t = 2
a	0.113**	0.065
	(2.297)	(1.309)
b	-0.013*	0.004
	(-0.944)	(0.643)
c	0.026**	0.011
	(2.003)	(0.833)
d	0.011	-0.047
	(0.239)	(-1.023)
e	-0.008**	-0.004
	(-2.380)	(-1.335)
f	0.002	0.030
	(0.251)	(0.346)
Adjusted R^2	1.6%	0.0%

4.5 Summary

I test the signalling hypothesis and the free cash flow hypothesis of dividend changes in Thailand between 2002 and 2005. The analysis of sample firms' profitability around dividend changes reveals that dividend-increasing firms do not have better profitability but dividend-decreasing firms experience a significant decline in profitability. Results from univariate analysis of the relation between dividend changes and subsequent profitability changes show that ROA changes of dividend changing firms significantly decline in one year after dividend announcements and no significant relation between these variables in two years after dividend announcements. Therefore, the findings show no or, if any, only a little indication that dividend changes signal changes in profitability in the same direction.

Then, I investigate whether dividend changes are lagged results of the past performance and find that dividend changes are positively related to the past profitability, as measured by earnings growth rates or ROA changes. These findings are consistent with those in Benartzi et al. (1997) who show that dividend changes signal the past rather than the future.

Further examination of the factors determining the size of dividend changes shows that the past ROA change is a positively significant determinant of the magnitude of dividend changes. Consistent with the free cash flow hypothesis, the results indicate that larger firm size and higher cash flow lead to greater magnitude of dividend changes, and that firms with lower MTB ratio make larger dividend changes. Additionally, I find that past dividend yield has a strongly negative impact on the size of dividend changes. This finding suggests a high level of dividend stability in Thailand. Further, I find that higher change in earned equity leads to larger dividend changes, the finding consistent with the life-cycle theory of dividends. Finally, I find a positive relation between debt ratio and the magnitude of dividend changes. This finding is surprising and casts doubt whether dividend increases by Thai firms are financed with debts. However, this issue is beyond the scope of this study.

Additional logit analysis of firm' decision to change dividends indicates that larger firms with better past profitability, higher cash flows, and higher earned equity change are more likely to increase dividends while higher-yield firms are less likely to increase dividends. On the other hand, larger firms with better past profitability, higher cash flows, and higher earned equity change are less likely to cut dividends while higher-yield firms and firms with higher MTB ratio are more likely to decrease dividends. These findings are broadly consistent with the implication of the free cash flow hypothesis that larger firms with higher profits and cash flows are better candidates to increase dividends.

Next, I analyse the short-run and long-run stock price performance around dividend changes. Consistent with evidence in the U.S., the Thai stock market reacts positively to dividend increase but negatively to dividend decrease announcements. Compared to that in the U.S., however, the average announcement return is higher for a dividend increase and lower for a dividend decrease. Analysis of long-run price performance shows negative and downward trends in buy-and-hold abnormal returns in 12 months and 24 months following dividend announcements for both dividend increases and dividend decreases. These findings suggest that Thai stock market appears to overreact to good news but underreact to bad news.

Subsequently, I examine the relation between announcement returns and hypothesised independent variables. I find that the magnitude of dividend changes is positively related to the magnitude of announcement returns and that a dividend increase by larger firms or firms with more cash flows leads to a higher stock price reaction, the findings consistent with the free cash flow hypothesis. Although dividend yield is a highly significant factor determining the magnitude of dividend changes, it is insignificant factor of announcement returns. Hence, there is no evidence in support for the dividend clientele hypothesis.

Analysis of firms' investment behaviours around dividend changes indicate that both low MTB and high MTB firms significantly increase their capital expenditures following dividend increase announcements. The finding for low MTB firms is therefore in contrast with a prediction of free cash flow hypothesis whereas the finding for high MTB firms is consistent with the signalling hypothesis. For dividend-decreasing group, I do not find any significant change in capital expenditures following dividend cuts for both low MTB and high MTB firms.

The examination of the factors explaining firm's subsequent investments reveals that there is a negative relation between dividend changes and capital expenditures in one year following dividend increase announcements, suggesting that a dividend increase helps alleviate overinvestment problem. It is also found that larger firms decrease their capital expenditures in one year after dividend changes, the evidence consistent with a prediction of the free cash flow hypothesis.

Overall, the findings offer almost no indication that dividend changes signal the future profitability. Rather, a dividend increase by the sample firms is used to signal to shareholders that overinvestment problem is being mitigated, thus increasing the firm value. Therefore, the empirical evidence of dividend changes in Thailand is broadly consistent with the free cash flow hypothesis rather than the signalling hypothesis.

In the next chapter, I investigate the share repurchase activities in Thailand over the period 2001-2007. The focus is to examine the stock market reaction to share repurchase announcements and to test whether the managers of repurchasing firms are able to time the market.

CHAPTER 5

Open Market Share Repurchases in Thailand

This chapter provides preliminary evidence on open-market share repurchase activities in Thailand from December 2001 to January 2007. It is divided into two main parts. In the first part, the stock market reactions to open market share repurchase announcements are examined. In the second part, the actual repurchase costs are compared with the costs of benchmark portfolios to test whether the managers of repurchasing firms are able to time the market.

5.1 Methods of Share Repurchases

Typically, share repurchases can be implemented in three ways: fixed-price tender offers, Dutch auctions, or open market repurchases.

In a fixed-price tender offer, a repurchasing firm firstly specifies the price at which it wants to repurchase shares, the number of shares sought, and the offering period. The shareholders then decide whether they want to sell shares to the firm at that specified price, and how many shares they want to tender to the firm. If the number of shares tenders is higher than the number of shares sought, the firm purchases shares on the pro-rata basis. If, on the other hand, the number of tendered shares is lower than the number of shares sought, the firm may choose to extend the repurchasing period. If too few shares are tendered, however, the firm may withdraw all the tendered shares prior to the expiration date.

In a Dutch auction repurchase[24], a repurchasing firm specifies a price range, instead of a single offer price, at which it wants to repurchase shares and the repurchasing period. The shareholders then submit the minimum acceptable price at which they are willing to sell within such specified range, along with the number of

[24] For more details, see Bagwell, L., 1992. "Dutch auction repurchases: An analysis of shareholder Heterogeneity." *Journal of Finance* 47, 71-105.

shares they want to sell. The firm collects this information, create a supply curve, which is used to determine the minimum price it can buy the number of shares sought, and then pay all investors who tendered at or below that price. If the number of shares tendered exceeds the number of shares sought, the firm can repurchase shares on the pro-rata basis or buy back all tendered shares at or below the determined price. On the other hand, if the number of tendered shares is lower than the number of shares sought, the firm can either cancel the repurchase programme or repurchase all tendered shares at the maximum price (within pre-specified price range) proposed by tendering shareholders.

In an open market repurchase (OMR), a firm announces its intention to buy back a number of shares without a commitment to do so. In the U.S., an open market repurchase programme generally takes several months or years to complete, and a substantial number of firms did not subsequently buy back shares after announcements at all (Stephens and Weisbach, 1998). From shareholders' perspectives, hence, there is a significant uncertainty at the time of an open market repurchase announcement whether the firm will actually repurchase shares as announced. From managerial perspectives, however, a stock repurchase announcement can be regarded as an option to repurchase shares (Ikenberry and Vermaelen, 1996), thereby providing much flexibility to the firm announcing a share repurchase programme.

5.2 Open Market Share Repurchase Regulations in Thailand

Thai listed companies were first allowed by the Stock Exchange of Thailand (SET) to repurchase their own shares on 21st December 2001. The SET stipulated[25] that repurchasing firms must show that they have ample accumulated profits and ability to repay debts due during the next six months, starting from the day they commence the share repurchase programme and that the number of free-float shares

[25] The OMR regulations by the SET are obtained from "Disclosure of information and other acts of a listed company in the case that a listed company repurchases their own shares and disposes of such repurchased shares, 2001".

not to fall below 15 percent. In addition, firms are prohibited from buying shares immediately prior to and when the key information is released to public. Moreover, firms must not buy back shares from connected persons.

To better protect shareholders' benefits and to avoid any negative impact on general market conditions, the SET subsequently amended the share repurchase rules, effective on 5th April 2004. In particular, a listed company will have to seek approval from shareholders in the case where share repurchases exceed 10 percent of paid-up capital.[26] If share repurchases do not exceed 10 percent, a firm should propose an amendment in the articles of association to the shareholder meeting to give the board of directors the authority to undertake share repurchase programme. Moreover, share repurchases are prohibited during a takeover period unless a company can demonstrate that it does not repurchase shares for a takeover purpose.

With regard to the information disclosure rules, listed companies are required to disclose to the SET their board resolutions approving share repurchases on the date of the meeting or up until 9.00 a.m. on the following trading day, and to disclose this information at least 14 days before they initiate share repurchase programmes. Furthermore, it is required that firms establish a repurchase price of no more than 115 percent of the average closing price over the previous five trading days and it is recommended that firms take into account the average closing price over the previous 30 days before the disclosure date in buying back shares.

A repurchasing firm may subsequently resell the repurchased shares, recorded on its balanced sheet as Treasury Stocks, via open market or by public offering, after 6 months from the completion date of share repurchases but not later than 3 years from that date. If a repurchasing firm has not resold repurchased shares within such period, the unsold treasury shares must be written off from its balanced sheet.

[26] The repurchase that exceeds 10% of the outstanding shares is treated as a tender offer repurchase.

The information disclosure requirements of share resale are similar to those of share repurchases. Listed companies must report to the SET any resolutions of the board of directors regarding proposed projects for share resale on the date of the meeting or up until 9.00 a.m. on the following trading day, and to disclose this information at least 14 days before they initiate share resale programmes. In addition, the firms are required to report the number of shares they want to resell; the procedure for reselling shares, which is either on the open market or by public offering; and the principle used to determine the resale price, which is not less than 85 percent of the average closing price over the previous five trading days.

5.3 The Sample

I obtained data mainly from SETSMART (SET Market Analysis and Reporting Tool), the web-based application of the Stock Exchange of Thailand, via the website www.setsmart.com. The first step is to browse the balanced sheets of listed companies and look for the "Treasury Stock" item recorded in the firm's equity. By doing so, only a few repurchasing firms are acquired since some firms that repurchased shares may subsequently resell all acquired shares so that there is no treasury stock item on their balanced sheets.

Then, I search the company news by using keywords "share repurchases" and "treasury stock". The most recent company news in the previous 6 months can be obtained from www.settrade.com and www.set.or.th. To obtain the older company news and historical trading data, I use the database of Kim Eng Securities (Thailand) Public Company Limited, a securities broker in Thailand, via www.kimeng.co.th.

Using various searching strategies through multiple sources, I have gathered a total of 26 open market share repurchase announcements made by 25 firms over the period December 2001 and January 2007. Of these 25 firms, only one firm made two announcements during the sample period. The summary statistics of repurchasing activities in Thailand are reported in Table 5.1 below.

Table 5.1 Summary Statistics of Open Market Share Repurchases in Thailand (December 2001 - January 2007)

Number of OMR announcements	26
Number of firms which announced OMRs	25
Number of shares announced for repurchase	1,326,761,436
Value announced for repurchase (Million Baht)	20,283.83
Average percentage (%) of equity announced for repurchase	7.29
Actual number of shares repurchased	543,451,969
Value of shares repurchased (Million Baht)	8,385.16
Average completion rate (%)	41.52
Average actual repurchasing days	29
Average 6-month debt to retained Earnings	0.58

Note that the average completion rate of OMRs by Thai firms is only about 42%, a level much lower than that reported in the U.S. of about 70-80% (see, e.g., Stephens and Weisbach, 1998; Jagannathan et al., 2000) despite more stringent repurchase regulations in Thailand.[27] Moreover, the average actual repurchasing days by Thai firms is only 29 days from the repurchasing period of approximately 120 trading days. From another perspective, however, the strict regulations for OMRs in Thailand might explain why only a few companies have repurchased shares.

Table 5.2 provides the descriptive statistics of OMR programmes by Thai firms. As required by the SET, repurchasing firms must report the details of their OMR programmes under "the share repurchase disclosure form" (See an example in Appendix C). Apart from providing the details of the maximum amount of money for the repurchase programme, the number of shares to be repurchased, and the implementation period, repurchasing firms must also report their retained earnings

[27] Thai firms must complete their OMR programmes within the next 6 months from the first repurchasing day, which is not less than 14 days after the announcement date, while the U.S. firms may buy back their shares within the next 2-3 years.

and the amount of debt due in the next six months following the first repurchasing day to ensure that they have sufficient liquidity to execute the OMR programmes.

Table 5.2 Descriptive Statistics of Open Market Share Repurchases in Thailand from December 2001 to January 2007

Company	Announcement Date	Repurchase Period From	Repurchase Period To	Amount (Baht)	No. of Shares to Repurchase	% of Shares Outstanding	Retained Earnings (Baht)	6-month Debt (Baht)
Advance Info Service	15/11/02	2/12/02	1/6/03	3,500,000,000	90,000,000	3.07	24,334,000,000	8,000,000,000
Aapico HiTech	16/5/06	30/5/06	29/11/06	847,080,000	28,236,000	10.00	1,494,438,335	150,000,000
BankThai	14/11/02	27/11/02	26/5/03	1,538,250,000	149,345,000	10.00	53,800,000	5,014,800,000
Dusit Thani *	19/9/03	1/10/03	30/12/03	193,500,000	4,500,000	5.29	362,500,000	116,700,000
Electricity Generating	17/12/01	2/1/02	1/7/02	1,500,000,000	42,860,000	8.16	3,978,810,000	743,000,000
Finansa	13/5/05	30/5/05	30/11/05	300,000,000	12,501,000	10.00	1,305,840,000	1,203,000,000
GMM Media	14/5/03	1/6/03	1/12/03	300,000,000	10,000,000	5.00	320,300,000	0
GMM Grammy	1/3/02	2/4/02	2/10/02	500,000,000	45,000,000	9.00	1,038,300,000	530,000
I.C.C. International	23/8/02	16/9/02	15/3/03	610,000,000	2,900,000	9.98	5,792,822,294	1,530,391,000
Thainox Stainless	21/11/05	6/12/05	5/6/06	580,000,000	400,000,000	5.00	608,186,064	1,896,000,000
Kiatnakin Bank	25/8/04	9/9/04	8/3/05	1,500,000,000	47,070,600	10.00	6,362,950,000	12,718,000,000
Lam Soon (Thailand)	13/11/02	1/12/02	31/5/03	150,000,000	82,000,000	10.00	178,945,991	277,977,394
MBK Development	10/4/03	23/4/03	22/10/03	700,000,000	20,000,000	10.00	1,097,909,000	0
Modernform Group	12/11/04	29/11/04	28/5/05	300,000,000	8,000,000	10.00	433,390,000	372,000,000
Prakit Holdings	16/12/04	1/1/05	30/6/05	30,000,000	1,800,000	3.00	421,395,436	80,442,336
Precious Shipping	29/3/04	10/4/04	9/10/04	1,000,000,000	26,000,000	5.00	563,637,665	770,000,000
The Safety Insurance	14/5/04	27/6/04	26/12/04	100,000,000	3,552,796	10.00	126,156,597	820,000,000
Siam City Cement**	29/6/06	14/7/06	13/1/07	1,800,000,000	75,000,000	3.00	3,254,600,000	0
Siam City Cement**	12/12/03	26/12/03	25/6/04	3,200,000,000	12,500,000	5.00	4,140,400,000	0
SE-Education	25/2/04	11/3/04	11/9/04	160,000,000	25,783,600	9.99	180,110,806	536,972,629
Srithai Superware	13/5/05	1/6/05	30/11/05	280,000,000	28,000,000	9.80	436,240,000	108,950,000
Siam United Services	27/6/05	15/7/05	15/1/06	30,000,000	35,000,000	2.94	134,040,000	24,000,000
Ratchthani Leasing	22/2/05	2/4/05	1/10/05	35,000,000	25,000,000	6.23	83,870,000	445,000,000
Thai Plastic and Chemicals	27/7/05	10/8/05	9/2/06	700,000,000	43,750,000	5.00	5,140,685,000	659,184,600
Tycoons Worldwide Group	18/11/05	1/12/05	31/5/06	230,000,000	25,000,000	3.98	1,191,000,000	1,994,000,000
Seamico Securities	28/2/06	15/3/06	14/9/06	200,000,000	82,962,440	10.00	1,104,790,000	0

*Dusit Thani announce a 3-month OMR programme. **Siam City Cement made 2 OMR announcements.

5.4 Market Reactions to OMR Announcements

5.4.1 Methodology

The initial market reaction to open market share repurchase announcements is measured by the cumulative average abnormal return (CAR) over various windows from twenty days before to twenty day afters the announcement date (day 0).

Standard event methodology of Brown and Warner (1985) is used to estimate the daily abnormal return (AR) and the cumulative average abnormal return (CAR) as follows:

$$AR_{it} = R_{it} - \hat{R}_{it} \tag{5.1}$$

$$\hat{R}_{it} = \alpha_i + \beta_i R_{mt} \tag{5.2}$$

Where

R_{it} is the return of stock *i* on day *t*; *t* = 0 represents the open market stock repurchase announcement day;

$\hat{R}_{it}$ is the expected return of stock *i* on day *t*;

α_i is the intercept of the model;

β_t is the systematic risk of stock *i*; and

R_{mt} is the SET index, which is a value-weighted index of all listed companies in the Stock Exchange of Thailand.

The window used to estimate the market model parameters α_i and β_i is (-250,-21).

Given *N* sample securities, the average abnormal return for day *t* is

$$\overline{AR}_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \ . \tag{5.3}$$

The daily average abnormal returns are then aggregated across an event window τ to obtain a cumulative average abnormal return (CAR)

$$CAR(\tau_1, \tau_2) = \sum_{t=\tau_1}^{\tau_2} \overline{AR}_t \; . \tag{5.4}$$

Equations (5.5) and (5.6) below are *t*-statistics used to test the null hypothesis that AR and CAR are not statistically different from zero

$$t_{AR} = \frac{\overline{AR}}{\sigma_{AR} / \sqrt{N}} \tag{5.5}$$

$$t_{CAR} = \frac{\overline{CAR}}{\sigma_{CAR} / \sqrt{N}} \tag{5.6}$$

5.4.2 Market Reactions to OMR Announcements

I begin an analysis of the initial market reaction to OMR announcements by plotting the graph of cumulative average abnormal returns (CARs) from 20 days before to 20 days after the announcement date (day 0) as shown in Figure 5.1. To investigate the longer-term market reaction, I plot the graph of CARs from 20 days before to 160 days after the announcement date as shown in Figure 5.2.

The figures show that the stock prices of repurchasing firms experienced negative CARs over 20 days prior to, but positive CARs during the OMR announcements. The CARs of repurchasing firms had fallen continuously over 40 days after the announcements but subsequently recovered and increased in the longer term.

Figure 5.1 Short-term Market Reactions to OMRs in Thailand

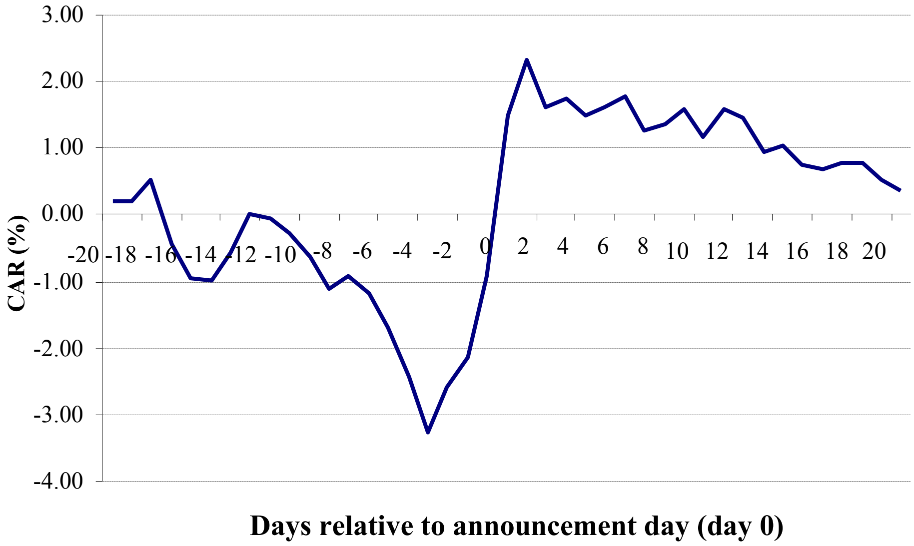

Figure 5.2 Longer-term Market Reactions to OMRs in Thailand

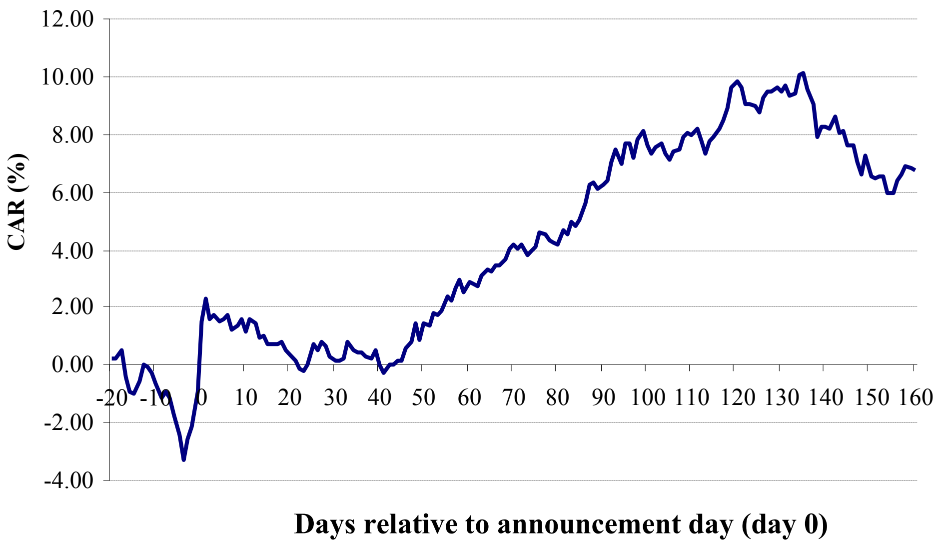

Table 5.3 provides analysis of market reactions to 26 share repurchase announcements by Thai firms. On average, the share prices of Thai repurchasing firms experienced negative cumulative abnormal returns of 3.04%, measured from -20 to -3 trading days preceding the open market share repurchase announcements. This finding is similar to that reported in the U.S. (see, e.g., Comment and Jarrell, 1991; Ikenberry et al., 1995; Grullon and Michaely, 2002), showing significant stock price declines prior to OMR announcements.

Table 5.3 Market Reactions to OMRs in Thailand

This table shows cumulative average abnormal returns of 26 open market share repurchase announcements over various windows from -20 days to +160 relative to announcement date (day 0). The abnormal returns (ARs) are calculated against the market model, in which parameters are estimated from -250 days to -21 days relative to announcement date (day 0).

	% Cumulative Average Abnormal Returns (CARs) over Window				
N=26	(-20,-3)	(-2, +2)	(+3, +20)	(+3, +120)	(+3, +160)
Mean	-3.041	4.223	-1.442	7.534	5.104
S.D.	9.835	6.974	10.875	26.783	33.349
t-statistic	-1.117	-3.280	-0.923	1.434	0.673
p-value	0.275	0.003	0.365	0.164	0.507

The mean announcement return during the event window (-2, +2) in Thailand is 4.22%, the level higher than the mean announcement return during the same window of 3.54% in the U.S. reported by Ikenberry et al. (1995) and the average initial market reaction reported by other researchers of approximately 3% (e.g. Vermaelen, 1981; Comment and Jarrell, 1991; Grullon and Michaely, 2002). Following the OMR announcements, the average CAR during the window (+3, +20) is -1.44%. However, stock prices of repurchasing firms show a positive drift in the longer term with the CAR of 7.53% and 5.10%, measured over windows (+3, +120) and (+3, +160) respectively.

5.5 Managerial Timing Ability

Open market share repurchases in Thailand allows one to test the managerial timing ability because the repurchasing firms are required to report the information on share repurchases such as the number of shares repurchased, the average price paid for the repurchased shares, and the amount of money spent for those repurchased shares, to the SET no later than 9 a.m. on the next business day. This information is disclosed to public via the websites www.set.or.th and www.settrade.com.

In order to test whether the managers of repurchasing firms have ability to time the market, the actual costs of repurchasing shares are compared with the costs of benchmark portfolios. For example, the cost of a benchmark portfolio in which a repurchasing firm repurchased shares with equal number of shares every day at the closing prices during the repurchasing period is compared with the cost of an actual portfolio in which a repurchasing firm repurchased different numbers of shares with different prices. If the cost of a benchmark portfolio is higher than that of an actual portfolio, the manager of a repurchasing firm may have shown ability to time the market.

Using Cook, Krigman, and Leach's (2004) methodology, I have constructed various benchmark portfolios, calculated their costs, and compared them with the actual cost to assess managerial timing ability as follows:

(i) The uniform repurchase cost (UC) is the cost of accumulating shares uniformly during the repurchasing period. The UC is defined as

$$UC_i = \sum_{t=1}^{T_i} \frac{V_i^R}{T_i} \times P_{it}^c \,, \tag{5.7}$$

where T_i is the number of trading days in the repurchasing period for firm i, $V_i^R = \sum_t V_{it}^R$ is the total number of shares repurchased in actual portfolio, and P_{it}^c is the closing price on day t for firm i.

(ii) The closing repurchase cost (CC) is the cost of repurchasing shares at closing prices for the actual repurchasing days. The CC is defined as

$$CC_i = \sum_{t \in RD_i} P_{it}^c V_{it}^R , \tag{5.8}$$

where P_{it}^c is the closing price on day t for firm i, V_{it}^R is the number of shares repurchased on day t for firm i, and RD_i is the set of actual repurchasing days.

(iii) The smoothing repurchase cost (SC) is the cost of repurchasing equal number of shares on every repurchasing day at the closing price. The SC is defined as

$$SC_i = \sum_{t \in RD_i} \frac{V_i^R}{T_{RD_i}} \times P_{it}^c , \tag{5.9}$$

where T_{RD_i} is the number of repurchasing days for firm i, $V_i^R = \sum_t V_{it}^R$ is the total number of shares repurchased in actual portfolio, P_{it}^c is the closing price on day t for firm i, and RD_i is the set of repurchasing days.

(iv) The immediate repurchase cost (IC) is the cost of repurchasing shares at the closing price immediately, starting from the first day of announced repurchasing period for every consecutive trading day until the total number of shares is equivalent to that in actual portfolio.

$$IC_i = \sum_{t=1}^{T_{RD_i}} P_{it}^c V_{it}^R , \tag{5.10}$$

where T_{RD_i} is the number of repurchasing days for firm i, P_{it}^c is the closing price on day t for firm i, and V_{it}^R is the number of shares repurchased on day t for firm i.

Table 5.4 Actual Repurchase Cost vs. Costs of Benchmark Portfolios

COMPANY	AC	MAX	MIN	UC	CC	SC	IC
Advance Info Service	82,922,450	83,530,425	82,311,025	100,962,186	83,347,850	84,969,690	85,873,800
Aapico HiTech	192,809,988	195,925,070	189,743,800	212,207,122	192,329,970	192,612,998	189,499,500
BankThai	789,581,115	795,374,350	783,909,920	820,813,798	792,815,215	813,227,587	823,591,465
Dusit Thani *	115,529,350	115,575,525	115,076,725	114,616,405	115,414,050	115,083,572	115,685,550
Electricity Generating	52,031,800	52,117,975	51,911,625	52,182,506	52,223,650	51,799,714	47,634,200
Finansa	25,037,260	25,372,500	24,919,147	27,424,986	25,320,070	24,873,107	29,906,630
MM Media	231,334,750	231,614,200	229,496,900	258,190,654	241,170,625	229,943,316	228,552,200
GMM Grammy	156,550,960	159,127,800	152,268,300	178,040,650	155,453,100	150,923,077	121,083,700
I.C.C. International	61,136,000	61,262,800	60,944,400	63,415,180	60,998,800	61,612,587	61,383,400
Thainox Stainless	248,935,341	252,856,360	245,050,847	225,877,638	248,483,536	245,149,080	272,416,404
Kiatnakin Bank	-	-	-	-	-	-	-
Lam Soon (Thailand)	127,612,900	128,197,230	127,485,820	128,983,220	128,172,030	131,829,302	129,966,390
MBK Development	394,496,175	394,496,475	394,078,675	467,594,150	397,498,450	396,086,350	400,789,775
Modernform Group	28,347,800	28,467,050	28,212,650	29,181,356	28,435,375	28,492,308	27,893,800
Prakit Holdings	5,415,280	5,415,280	5,415,280	6,028,170	5,415,280	5,407,680	6,402,740
Precious Shipping	449,756,325	454,482,950	445,869,175	466,390,861	448,561,300	454,095,608	452,653,950
The Safety Insurance	60,894,137	61,312,283	57,510,947	56,943,953	61,054,083	58,079,581	51,774,343
Siam City Cement**	1,699,352,600	1,702,383,200	1,681,381,400	1,827,338,710	1,690,446,000	1,785,000,000	1,616,289,800
Siam City Cement**	2,977,979,000	2,989,974,800	2,956,569,600	2,911,776,860	2,980,727,800	2,922,435,897	3,054,259,400
SE-Education	122,641,095	122,705,605	122,020,440	124,547,492	122,670,595	124,558,587	124,813,320
Srithai Superware	127,309,640	127,941,936	126,757,385	126,729,074	127,295,520	127,069,361	127,759,011
Siam United Services	24,610,000	24,762,210	24,446,622	23,475,200	24,728,895	24,613,514	24,435,180
Ratchthani Leasing	1,837,978	1,850,489	1,829,967	1,924,537	1,846,989	1,850,333	2,139,489
Thai Plastic and Chemicals	-	-	-	-	-	-	-
Tycoons Worldwide Group	209,043,465	211,781,230	203,166,660	196,082,852	207,572,195	196,085,477	199,036,950
Seamico Securities	199,990,000	201,239,424	198,065,912	200,172,324	200,402,074	201,401,470	227,565,006
TOTAL	**8,385,155,409**	**8,427,767,166**	**8,308,443,222**	**8,620,899,883**	**8,392,383,452**	**8,427,200,196**	**8,421,406,003**

Notes: AC is the actual repurchase cost. MAX is the cost of repurchasing shares at the highest prices for the actual repurchasing days. MIN is the cost of repurchasing shares at the lowest prices for the actual repurchasing days. The uniform repurchase cost (UC) is the cost of accumulating shares uniformly during the repurchasing period. The closing repurchase cost (CC) is the cost of repurchasing shares at closing prices for the actual repurchasing days. The smoothing repurchase cost (SC) is the cost of repurchasing equal number of shares on every repurchasing day at the closing prices. The immediate repurchase cost (IC) is the cost of repurchasing shares at the closing price immediately, starting from the first day of repurchase period for every consecutive trading day until the total number of shares is equivalent to that in actual portfolio.

Table 5.5
Sign Test of Differences between Actual Repurchase Cost and Costs of Benchmark Portfolios

Sign	AC-UC	AC-CC	AC-SC	AC-IC
Negative	17	14	12	15
Positive	7	9	12	9
Ties	0	1	0	0
Total	24	24	24	24
Sign Test (p-value)	0.064	0.405	1.000	0.307

Notes: Two firms that did not actually repurchase shares (Kiatnakin Bank and Thai Plastic and Chemicals) are not included. AC is the actual repurchase cost. The uniform repurchase cost (UC) is the cost of accumulating shares uniformly during the repurchasing period. The closing repurchase cost (CC) is the cost of repurchasing shares at closing prices for the actual repurchasing days. The smoothing repurchase cost (SC) is the cost of repurchasing equal number of shares on every repurchasing day at the closing prices. The immediate repurchase cost (IC) is the cost of repurchasing shares at the closing price immediately, starting from the first day of repurchase period for every consecutive trading day until the total number of shares is equivalent to that in actual portfolio.

Table 5.4 provides details for actual repurchasing costs and the costs of benchmark portfolios. The figures show that the cost of actual share repurchases is lower than the costs of all benchmark portfolios, suggesting that the managers of repurchasing firms possess substantial timing ability.

Table 5.5 shows the sign test of the differences between actual repurchasing cost (AC) and four benchmark portfolios (UC, CC, SC, and IC). Note that two firms that did not actually buy back shares are not included in the sign test. The results indicate that 17 out of 24 firms (70.83%) have actual repurchase cost (AC) lower than uniform repurchase cost (UC); 14 out of 24 firms (58.33%) have actual repurchase cost (AC) lower than closing repurchase cost (CC); 12 out of 24 firms (50%) have actual repurchase cost (AC) lower than smoothing repurchase cost; and 15 out of 24 firms (62.5%) have actual repurchase cost (AC) lower than immediate repurchase cost. Although the differences are not statistically significant, the overall results demonstrate that the actual repurchase costs of most repurchasing firms are lower than the costs of benchmark portfolios. This evidence suggests that the managers of repurchasing firms in Thailand are able to time the market.

5.6 Summary

This chapter provides preliminary evidence on open-market share repurchases in Thailand from December 2001 to January 2007. The results from the examination of stock price reactions surrounding open-market share repurchases in Thailand reveal that share prices of repurchasing firms significantly decline prior to but reacts positively upon OMR announcements. These findings show that open-market share repurchases are good news for investors. In addition, it is found that share prices of repurchasing firms earn positive CARs over the market index in the longer-term subsequent to OMR announcements, indicating that Thai stock market underreacts to OMR announcements. In a further investigation of managerial timing ability, the results reveal that the costs of actual repurchase portfolio are lower than those of benchmark portfolios, suggesting that the managers of repurchasing firms repurchase shares in order to time the market and they are successful in doing so.

Nevertheless, it is recognised that the small sample size limits the power of statistical tests of the results in this chapter. Thus, it will be worthwhile to re-examine the share repurchases in Thailand in the future when the number of repurchase activities increase to a certain level in order to obtain a more complete picture of payout policy in this emerging market.

CHAPTER 6
Conclusions

This thesis aims to shed additional light on dividend puzzle. Accordingly, two theoretical models related to the corporate dividend policy have been developed. The first model, developed in spirit of Isagawa (2000), demonstrates a situation in which the manager chooses to payout free cash flows to shareholders in the form of dividends or share repurchases, or to invest cash flows in a real project from which he can take private benefits. I focus on the case in which the return on investment for high-quality firm (firm H) is positive whereas that for low-quality firm (firm L) is negative. That is, firm H has a better prospect and firm L has a worse prospect. The model is then analysed in three cases according to managerial weight parameter: (1) the manager balances his short-term and long-term payoffs; (2) the manager maximises only his short-term payoff; and (3) the manager maximises only his long-term payoff.

The results show that, regardless of the managerial weight parameter, paying dividends is a dominated strategy for firm H. The manager of firm H has two better alternatives. Firstly, he can invest cash flow in a positive NPV project from which he also obtains private benefits or, secondly, he can buy back undervalued shares to benefit long-term shareholders. If the manager places equal weight to his short-term and long-term payoffs, there exist three equilibria: (1) a pooling equilibrium in which both firms repurchase shares if the private benefit is too low for both firms; (2) a separating equilibrium in which firm H invests in the new project whereas firm L repurchases shares if the private benefit is high enough for firm H but too low for firm L; and (3) a pooling equilibrium in which both firms invest in the new project is sufficiently high for both firms. If the manager is myopic, firm L has a strong incentive to make a false signal to the market by announcing a share repurchase programme. In this case, there exists a pooling equilibrium in which both firms repurchase shares if the private benefit is too low for both firms, and a pooling equilibrium in which both firms invest in the new project if the private benefit is sufficiently high for both firms. Note that, for a pooling equilibrium in which both firms invest in the new project to be achieved, the manager needs higher private benefits as he places more weight on the short-term payoff. If the manager is farsighted, there exist a separating equilibrium in which firm *H* invests in the new project while firm *L* repurchases shares if the private benefit is too low for firm *L* and a pooling equilibrium in which both firms invest in the new project if the private benefit is high enough for firm *L*. Note that, for a pooling equilibrium in which both firms invest in the new project to be achieved, the manager needs lower private benefits as he places more weight on the long-term payoff.

Further, I analyse the case in which the investors are irrational in that they do not update their beliefs upon observing one firm repurchase shares while the other pays dividends. In other words, investors fail to recognise that managers may buy back shares in order to time the market. If the manager balances his short-term and long-term payoff, there exist a separating equilibrium in which firm *H* invests in the new project while firm *L* repurchases shares and a pooling equilibrium in which both firms invest in the new project. Note that, there is no pooling equilibrium in which both firms repurchase shares under this case. The reason is that firm *L* cannot obtain any benefit from mimicking firm *H* if the market underreacts to share repurchase announcements. If the manager is myopic, there exists a pooling equilibrium in which both firms invest in the new project. Under this case, the manager requires higher private benefit, compared to that in the case where he balances the payoffs, in order to invest in the new project. On the other hand, if the manager is farsighted, there exist the same equilibria as in the case where the manager balances his payoffs but the manager requires lower private benefit in order to invest in the new project. Hence, the higher the long-term managerial weight, the lower the private benefits the manager needs for investing in the new project and vice versa.

The second model is a catering model, developed in spirit of Fairchild and Zhang (2005), in which it shows that managers may use excess cash to cater to investor demand by paying dividends or repurchasing shares, or alternatively, investing in a real project to take private benefits. The dividend and repurchase premia are introduced in this model. Like the previous model, this model focuses on the case in which the high-quality firm (firm *H*) has a positive NPV project available whereas the low-quality firm (firm *L*) has a negative NPV project available.

The key assumptions of this model are: (1) investors do not update their beliefs when they observe one firm paying dividends and the other repurchasing shares; and (2) investors react fully and immediately to dividend announcements but slowly to share repurchase announcements. The model demonstrates that the firm's payout/investment policies depend on: (1) the gain/loss from investment; (2) the manager's time horizon; (3) the relative magnitude of dividend and repurchase premia; and (4) the degree of information asymmetry between managers and investors.

The model shows that a myopic manager may pass up a positive NPV project in order to cater to investor demand for dividends or share repurchases. That is, there exists an adverse selection problem. Hence, paying dividends or repurchasing shares is inefficient for the high-quality firm. Fairchild (2008) point out that this adverse selection problem may be mitigated by investor communication, reinforced by managerial reputation effects. On the other hand, the low-quality firm may have a strong incentive to pay dividends if the dividend-catering premium is higher than the private benefit from investing in a negative NPV project. That is, a moral hazard problem is mitigated under this case. The results also demonstrate that the higher the long-term managerial weight, the higher dividend catering premium required by the manager for paying dividends. On the other hand, the higher the short-term managerial weight, the lower dividend catering premium required by the manager for paying dividends.

Subsequently, I investigate dividend policy of firms listed in Thai stock market over the period 2001-2005. I focus on testing the two competing theories in dividend literature: the signalling hypothesis and the free cash flow hypothesis. The analysis of sample firms' profitability around dividend changes reveals that dividend-increasing firms do not have better profitability but dividend-decreasing firms experience a significant decline in profitability. Results from univariate analysis of the relation between dividend changes and subsequent profitability changes show that ROA changes of dividend changing firms significantly decline in one year after dividend announcements and no significant relation between these variables in two years after dividend announcements. Therefore, the findings show no or, if any, only a little indication that dividend changes signal changes in profitability in the same direction. Then, I examine whether dividend changes are lagged results of the past profitability. The results reveal that dividend changes are positively related to the past profitability changes. These findings are consistent with those in Benartzi, Michaely, and Thaler (1997) who show that dividend changes signal the past rather than the future.

Further analysis of the factors affecting the size of dividend changes indicates that the past ROA changes are significantly positive determinants of the magnitude of dividend changes. The results also indicate that larger firm size and higher cash flow lead to greater magnitude of dividend changes, the findings consistent with the free cash flow hypothesis. In addition, lower MTB leads to higher dividend changes, the finding also supporting the free cash flow hypothesis. Moreover, I find that past dividend yield has a strongly negative impact on the magnitude of dividend changes. This finding suggests a high level of dividend stability in Thailand. Moreover, I find that earned equity change is a significantly positive factor of dividend changes, the findings consistent with the life-cycle theory of dividends. Finally, I find a positive relation between debt ratio and the magnitude of dividend changes. This finding casts doubt whether dividend increases by Thai firms are financed with debt. However, this issue is beyond the scope of this study.

The results from additional logit analysis of firms' decision to change dividends show that larger firms with better past profitability, higher cash flows, and higher earned equity change are more likely to raise dividends while firms with higher market-to-book ratio and past dividend yield are less likely to raise dividends. On the other hand, larger firms with better past profitability, higher cash flows, and higher earned equity change are less likely to cut dividends while higher-yield firms and firms with higher market-to-book ratio are more likely to cut dividends. These findings are broadly consistent with the implication of the free cash flow hypothesis that larger firms with higher profits and cash flows are better candidates to increase dividends.

Further, I analyse the short-run and long-run stock price performance around dividend changes. Consistent with evidence in the U.S., the Thai stock market reacts positively to dividend increase but negatively to dividend decrease announcements. Compared to that in the U.S., however, the average announcement return is higher for a dividend increase and lower for a dividend decrease. The analysis of long-run stock price performance shows negative and downward trends in buy-and-hold abnormal returns in 12 months and 24 months following dividend announcements for both dividend increases and dividend decreases. These findings suggest that Thai stock market appears to overreact to good news (dividend increases) but underreact to bad news (dividend cuts).

Then, I examine the relation between announcement returns and hypothesised independent variables. Consistent with the signalling hypothesis, I find that the size of dividend changes is positively related to the size of announcement returns. I also find that a dividend increase by larger firms and firms with higher cash flows leads to higher positive stock market reaction, a finding consistent with the free cash flow hypothesis. Dividend yield is, nevertheless, an insignificant factor of announcement returns. Hence, there is no evidence in support of the dividend clientele hypothesis.

Finally, I investigate firms' investment behaviours surrounding dividend changes. The results indicate that both low MTB and high MTB firms significantly increase their capital expenditures following dividend increase announcements. The finding for low MTB firms is therefore in contrast with a prediction of the free cash flow hypothesis while the finding for high MTB firms is consistent with the signalling hypothesis. For dividend-decreasing group, I do not find any significant change in capital expenditures following dividend cuts for both low MTB and high MTB firms. In addition, I find that there is a negative relation between the size of dividend increase and capital expenditure in one year following dividend increase announcements, a result suggesting that a dividend increase can help mitigate overinvestment problem. It is also found that firms with higher cash flows increase their capital expenditures in one year after dividend increases, a finding consistent with a prediction of the free cash flow hypothesis.

Overall, the findings offer almost no indication that dividend changes signal future profitability. Rather, a dividend increase by the sample firms is used to signal to shareholders that overinvestment problem is being mitigated. Therefore, the empirical evidence of dividend changes in Thailand is broadly consistent with the free cash flow hypothesis rather than the signalling hypothesis.

In addition to investigating dividend policy of Thai public companies, I also examine open market repurchase activities in Thailand from December 2001 to January 2007. Analysis of stock market reactions to 26 share repurchase announcements made by Thai firms during such period indicates that, on average, the share prices of repurchasing firms experience a negative cumulative abnormal return prior to open market share repurchase announcements, and earn a positive cumulative abnormal return during share repurchase announcements. These results are consistent with those in the U.S. (e.g., Comment and Jarrell, 1991; Ikenberry et al., 1995; Grullon and Michaely, 2002). Immediately following the open market share repurchase announcements, stock prices of repurchasing firms experience negative cumulative abnormal returns. However, their stock prices subsequently show a positive drift and earn a positive cumulative abnormal return in the longer term. These findings suggest that Thai stock market underreacts to open market share repurchase announcements.

I further test whether the managers of repurchasing firms have ability to time the market. Comparing the actual cost of shares repurchased with the costs of various benchmark portfolios, I find that the cost of actual portfolio is lower than the costs of benchmark portfolios, suggesting that the managers of repurchasing firms in Thailand have substantial ability to time the market.

In summary, this study makes contributions to existing payout literature both theoretically and empirically. Theoretically, the models demonstrate that the payout policy is indeed complex since it is affected by several factors such as the managerial motives to signal undervaluation, to disgorge free cash flows, or to time the market. The models also demonstrate that payout policy may be affected by behavioural biases such as investor demand for dividends and share repurchases. The models that incorporate behavioural factors of both managers and shareholders may be better at explaining payout policy in the real world, thus offering interesting area for future research.

The empirical tests of dividend policy in Thailand indicate that Thai firms pay dividends in order to disgorge free cash flows rather than to signal better profitability. This result may not be applied in other emerging countries. Therefore, the tests of the dividend signalling hypothesis and the free cash flow hypothesis in other developing economies are required to help explain the dividend puzzle. Since this thesis focuses only on the dividend changes of Thai firms over the short period, the future research therefore could be to investigate the firms' dividend policy over the longer period using a larger sample size. A better approach such as a vector autoregressive model (VAR) can be employed to examine the dynamic relations between dividends and earnings and test the signalling and smoothing hypotheses (see, e.g., Chen and Wu (1999); Goddard et al. (2006)). Moreover, the study of other factors that could affect dividend policy of Thai firms such as cash flow permanence, ownership structure, and capital structure also offer promising area for future research. Recently, Brockman and Unlu (2009) study the effect of creditor rights on dividend policies in 52 countries around the world and find that the probability and the amount of dividend payouts are significantly lower in countries with poor creditor rights. Therefore, it is also interesting to examine more closely whether the agency costs of debt play a significant role in determining dividend policies of Thai firms.

The investigation of open market share repurchases in Thailand is limited by a small sample size. The preliminary results indicate that open market share repurchase announcements in Thailand are perceived as good news. However, investors appear to initially underreact to open market share repurchase announcements. Hence, the managers use this opportunity to time the market and they are successful in doing so. As the open market share repurchase activities in Thailand increase to a certain level in the future, the examination of repurchasing firms' operating performances before and after share repurchases can be used in testing the signalling and free cash flow hypotheses. In addition, the researcher could examine whether the open market share repurchases in Thailand result in the wealth transfer from bondholders to stockholders. Moreover, it can be tested whether the open market share repurchases have liquidity impact on the stock market. Thus, it will be worthwhile to revisit and conduct more tests to obtain a more complete picture of payout policy in Thailand.

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Appendix A

Proof of Lemma 1

a) If both firms pay dividends at date 1, the market cannot distinguish firm types, so the market values of both firms are the same at $V_{1H} = V_{1L} = \overline{V_0} = \dfrac{Y_H + Y_L + 2X}{2}$. At date 2, as all information is revealed, the cum-dividend value of firm H and firm L are $Y_H + X$ and $Y_L + X$ respectively.

b) In this strategy pair $\{D, R\}$, firm L sends false signal to the market so that the market mistakenly believes that the low-quality type is the high-quality type and, conversely, the high-quality type is the low quality type at date 1. Therefore, the market value of high-quality firm decreases to $Y_L + X$, and the market value of low-quality firm increases to $Y_H + X$ at date 1. The proportion of shares repurchased is $\theta = \dfrac{X}{\hat{V}_1} = \dfrac{X}{Y_H + X}$. Thus, the number of shares repurchased (and destroyed) is $N_R = \dfrac{X}{\widehat{P}_1} = \dfrac{XN}{Y_H + X}$. As a result, the new total number of shares is $N - N_R = \dfrac{Y_H N}{Y_H + X}$. The manager still holds N_M. Therefore, the manager's post-repurchase equity stake is

$$\beta = \frac{N_M}{N - N_R} = \frac{N_M (Y_H + X)}{NY_H} = \frac{Y_H + X}{Y_H}\alpha.$$

Substituting $\hat{V}_1, V_2, and \beta$ into (M1), I obtain firm L's payoff given in lemma 1b).

c) The strategy pair $\{R, D\}$ is consistent with the market's belief $\{H, L\}$. Hence, the market value of high-quality firm increases to its fundamental value

$Y_H + X$, and the market value of low-quality firm decreases to its fundamental value $Y_L + X$ at date 1.

d) If both firms repurchase at date 1, the manager's payoff is derived as follows. Initially, the manager has N_M shares, and the outsiders have N_S shares. Therefore, the total number of shares is $N = N_M + N_S$ and $\alpha = \frac{N_M}{N}$. At date 0, prior to the policy announcement, the value of the firm and price per share are

$$\overline{V}_0 = \frac{Y_H + Y_L + 2X}{2}, \ \overline{P}_0 = \frac{Y_H + Y_L + 2X}{2N}.$$

At date 1, the manager repurchases $X = \theta \hat{V}_1$. Since both firms repurchase, the type is not revealed at date 1. Hence, $\hat{V}_1 = \overline{V}_0$, and $\hat{P}_1 = \overline{P}_0$. Therefore, the proportion of repurchased shares is $\theta = \frac{X}{\hat{V}_1} = \frac{2X}{Y_H + Y_L + 2X}$. Thus, the number of shares repurchased (and destroyed) is $N_R = \frac{X}{\hat{P}_1} = \frac{2XN}{Y_H + Y_L + 2X}$. The new total number of shares is $N - N_R = \frac{(Y_H + Y_L)N}{Y_H + Y_L + 2X}$. The manager still holds N_M. Therefore, the manager's post-repurchase equity stake is

$$\beta = \frac{N_M}{N - N_R} = \frac{N_M(Y_H + Y_L + 2X)}{N(Y_H + Y_L)} = \frac{Y_H + Y_L + 2X}{Y_H + Y_L}\alpha.$$

Substituting $\hat{V}_1, V_2, and \beta$ into (M1), I obtain the payoffs in lemma 1d). ■

Proof of Proposition 1

- If firm *L* pays dividends, equations (a) and (e) are compared to find firm *H*' best response. Subtracting equation (a) from (e) yields $\alpha w_1 \left(\frac{Y_H - Y_L}{2} \right)$, which is positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

- If firm L pays dividends, equations (c) and (g) are compared to find firm H' best response. Subtracting equation (c) from (g) yields

$$\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right] \tag{P1}$$

  Since (P1) is positive, firm H will choose to repurchase shares rather than pay dividends.

- Given that firm H repurchases shares, equations (f) and (h) are compared to find firm L's best response. Subtracting (f) from (h) yields

$$\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right)\right] \tag{P2}$$

  Given $w_1 = w_2 = 1/2$, (P2) is positive if $\left(\frac{Y_H - Y_L}{2}\right) > X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$ but negative if $\left(\frac{Y_H - Y_L}{2}\right) < X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$.■

Proof of Lemma 2

a) The same as proof of lemma 1a)
b) If the market does not update its belief once observing $\{D, R\}$, the value of the firm and price per share are still the same

$$\overline{V}_0 = \frac{Y_H + Y_L + 2X}{2}, \ \overline{P}_0 = \frac{Y_H + Y_L + 2X}{2N}.$$

   Thus, firm L repurchases (overvalued) shares at a pooling price.

Therefore, the proportion of repurchased shares is $\theta = \frac{X}{\hat{V}_1} = \frac{2X}{Y_H + Y_L + 2X}$.

The number of shares repurchased (destroyed) is $N_R = \frac{X}{\hat{P}_1} = \frac{2XN}{Y_H + Y_L + 2X}$

The new total number of shares is $N - N_R = \frac{(Y_H + Y_L)N}{Y_H + Y_L + 2X}$. The manager still holds N_M. Therefore, the manager's post-repurchase equity stake is

$$\beta = \frac{N_M}{N - N_R} = \frac{N_M(Y_H + Y_L + 2X)}{N(Y_H + Y_L)} = \frac{Y_H + Y_L + 2X}{Y_H + Y_L}\alpha.$$

Substituting $\hat{V}_1, V_2, and \beta$ into (M1), I obtain the payoffs in lemma 1b).

c) If the market does not update its belief once observing $\{R, D\}$, the value of the firm and price per share are still the same

$$\overline{V}_0 = \frac{Y_H + Y_L + 2X}{2},\ \overline{P}_0 = \frac{Y_H + Y_L + 2X}{2N}.$$

Thus, firm *H* can repurchase (undervalued) shares at a pooling price. The rest is the same as in the proof of lemma 1b).

d) The same as proof of lemma 1d).■

Proof of Proposition 2

- If firm *H* pays dividends, equations (j) and (l) are compared to find firm *L*'s best response. Subtracting (l) from (j) yields $\alpha w_2\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is positive. Therefore, firm *L* chooses to pay dividends rather than repurchase shares.

- If firm *H* repurchases shares, equations (n) and (p) are compared to find firm *L*'s best response. Subtracting (p) from (n) yields $\alpha w_2\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is positive. Therefore, firm L chooses to pay dividends rather than repurchase shares.

- If firm L's dominant strategy is to pay dividends, equations (i) and (m) are compared to find firm H's best response. Subtracting (i) from (m) yields $\alpha w_2\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is positive. Therefore, firm H chooses to repurchase shares rather than pay dividends.

Hence, there exists a unique separating equilibrium where firm H repurchases shares and firm L pays dividends. ■

Proof of Lemma 3

a) The same as proof of lemma 1a).
b) The same as proof of lemma 1b).
c) If the market observes $\{D, I\}$, the market incorrectly distinguishes firm types at date 1. Thus, the market value of firm H decreases to $Y_L + X$ while that of firm L increases to $Y_H + X(1+r_H)$ at date 1. At date 2, as all information is revealed, the cum-dividend value of firm H is $Y_H + X$, and the value of firm L when its return from the project is realised is $Y_L + X(1+r_L)$. In addition, firm L receives private benefit from investment B.
d) The same as proof of lemma 1c).
e) The same as proof of lemma 1d)
f) If firm H repurchases shares and firm L invests in the new project, the market can correctly distinguish the firm types at date 1. Thus, the market value of firm H increases to its true value at $Y_H + X$, and the market value of firm L decreases to $Y_L + X(1+r_L)$ because the market knows that firm L is investing in a negative NPV project.
g) When the market observes $\{I, D\}$, the market can correctly distinguish firm types. The market value of firm H increases to $Y_H + X(1+r_H)$ while that of

firm L decreases to $Y_L + X$ **.** At date 2, as all information is revealed, the cum-dividend value of firm L is $Y_L + X$, and the value of firm H when its return from the project is realised is $Y_H + X(1+r_H)$. In addition, firm H receives private benefit from investment B.

h) If firm H invests in the new project and firm L repurchases shares, the market incorrectly distinguish the firm types at date 1. Thus, the market value of firm H decreases to $Y_L + X(1+r_L)$ because the market mistakenly believes that firm H is firm L and it knows that firm L invests in a negative NPV project. On the other hand, the market value of firm L increases to $Y_H + X$ at date 1. Since firm L repurchases overvalued shares at $\hat{P}_{1L}(R) = \frac{Y_H + X}{N}$, the number of shares repurchased (and destroyed) is $N_R = \frac{X}{\widehat{P}_1} = \frac{XN}{Y_H + X}$. As a result, the new total number of shares is $N - N_R = \frac{Y_H N}{Y_H + X}$. The manager still holds N_M. Therefore, the manager's post-repurchase equity stake is

$$\beta = \frac{N_M}{N - N_R} = \frac{N_M (Y_H + X)}{NY_H} = \frac{Y_H + X}{Y_H}\alpha.$$

Substituting $\hat{V}_1, V_2, and \beta$ into (M2), I obtain firm L's payoff given in lemma 3h).

i) If both firms invest in the new project, the market cannot update its belief at date 1. Hence, the market values of both firms are the same at $V_{1H} = V_{1L} = \overline{V}_0 = \frac{Y_H + Y_L + 2X}{2}$. At date 2, the project return is realised and both firms receive benefits from investment.■

Proof of Lemma 4

(a) If firm L pays dividends, equations (1), (7), and (13) are compared to find firm H's best response. Subtracting (1) from (7) yields $\alpha w_1\left(\frac{Y_H - Y_L}{2}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

Subtracting (7) from (13) yields

$$\alpha(1-w_3)Xr_H + w_3B \tag{P3}$$

Since (P3) is obviously positive, firm H will choose to invest in the new project rather than repurchase shares.

(b) If firm L repurchases shares, equations (3), (9), and (15) are compared to find firm H's best response.

Subtracting (3) from (9) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

Subtracting (9) from (15) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3B \tag{P4}$$

Given that $w_1 = w_2 = w_3 = 1/3$, and $r_H + r_L = 0$, (P4) becomes

$$\frac{\alpha}{3}\left[\left(\frac{Y_L - Y_H}{2}\right) + X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right)\right] + \frac{B}{3} \tag{P5}$$

Hence, firm H chooses to invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$, but choose to repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$.

(c) If firm L invests in the new project, equations (5), (11), and (17) are compared to find firm H's best response.

Subtracting (5) from (11) yields $\alpha w_1 (Y_H - Y_L)$, which is obviously positive. Thus, firm H will choose to repurchase shares rather than pay dividends.

Subtracting (11) from (17) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2 X r_H\right] + w_3 B \tag{P6}$$

Given assumption (a1), (P6) is positive. Therefore, firm H chooses to invest in the new project rather than repurchase shares. ■

Proof of Lemma 5

(a) If firm H repurchases shares, equations (8), (10), and (12) are compared to find firm L's best response.

Subtracting (8) from (10) yields

$$\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right)\right] \tag{P7}$$

Given $w_1 = w_2 = w_3 = 1/3$ and assumption (a1), it follows that (P7) is positive. Hence, firm L will choose to repurchase shares rather than pay dividends.

Subtracting (10) from (12) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + Xr_L\right)\right] + w_3 B \quad \text{(P8)}$$

Substituting $w_1 = w_2 = w_3 = 1/3$ into (P8) yields

$$\frac{\alpha}{3}\left[\left(\frac{Y_L - Y_H}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right] + \frac{B}{3} \quad \text{(P9)}$$

Hence, firm L will choose to invest in the new project if $B > \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$ but choose to repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$.

(b) If firm H invests in the new project, equations (14), (16), and (18) are compared to find firm L's best response.

Subtracting (14) from (16) yields

$$\alpha\left[w_1(Y_H - Y_L) + w_2 X\left(\frac{Y_L - Y_H}{Y_H}\right)\right] \quad \text{(P10)}$$

Given that $w_1 = w_2 = w_3 = 1/2$ and assumption (a1), (P10) is positive. Hence, firm L will choose to repurchase shares rather than pay dividends.

Subtracting (16) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right)\right] + w_3 B \quad \text{(P11)}$$

Substituting $w_1 = w_2 = w_3 = 1/3$ into (P11) yields

$$\frac{\alpha}{3}\left[\left(\frac{Y_L - Y_H}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right] + \frac{B}{3} \tag{P12}$$

Hence, firm L will choose to invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$ but choose to repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.

Proof of Corollary 2

Substituting $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$ into equations (1) to (18), I re-analyse the equilibrium as follows:

- If firm L pays dividends, equations (1), (7), and (13) are compared to find firm H's best response. Subtracting (1) from (7) yields $\alpha w_1\left(\frac{Y_H - Y_L}{2}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather pay dividends. Subtracting (7) from (13) yields $\alpha(1 - w_3)Xr_H + w_3 B$, which is positive. Thus, firm H will invest in the new project rather than repurchase shares.

- If firm L repurchases shares, equations (3), (9), and (15) are compared to find firm H's best response.

  Subtracting (3) from (9) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$, which is positive. Hence, firm H will not choose to pay dividends.

Subtracting (9) from (15) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B$$

Therefore, firm H will invest in the new project if $B \geq 3\alpha\left[(Y_H - Y_L) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$ but choose to repurchase shares if $B < 3\alpha\left[(Y_H - Y_L) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$.

- If firm L invests in the new project, equations (5), (11), and (17) are compared to find firm H's best response. Subtracting (5) from (11) yields $\alpha w_1 (Y_H - Y_L)$, which is obviously positive. Hence, firm H will not choose to pay dividends. Subtracting (11) from (17) yields $\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2 Xr_H\right] + w_3 B$, which is positive. Thus, firm H will choose to invest in the new project.

- If firm H repurchase shares, equations (8), (10), and (12) are compared to find firm L's best response. Subtracting (8) from (10) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right)\right]$, which is positive. Hence, firm L will not choose to pay dividends. Subtracting (10) from (12) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + Xr_L\right)\right] + w_3 B$$

Therefore, firm L will invest in the new project if $B \geq 3\alpha\left[\left(Y_H - Y_L\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$ but repurchase shares if $B < 3\alpha\left[\left(Y_H - Y_L\right) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$.

- If firm H invests in the new project, equations (14), (16), and (18) are compared to find firm L's best response. Subtracting (14) from (16) yields $\alpha\left[w_1\left(Y_H - Y_L\right) + w_2 X\left(\frac{Y_L - Y_H}{Y_H}\right)\right]$, which is positive. Hence, firm L will not choose to pay dividends.

Subtracting (16) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right)\right] + w_3 B$$

Thus, firm L will invest in the new project if $B \geq 3\alpha\left[\left(Y_H - Y_L\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$ but repurchase shares if $B < 3\alpha\left[\left(Y_H - Y_L\right) + X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.

Proof of Corollary 3

Substituting $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$ into equations (1) to (18), I re-analyse the equilibrium as follows:

- If firm L pays dividends, equations (1), (7), and (13) are compared to find firm H's best response. Subtracting (1) from (7) yields $\alpha w_1\left(\frac{Y_H - Y_L}{2}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather pay dividends. Subtracting (7) from (13) yields $\alpha(1-w_3)Xr_H + w_3B$, which is positive. Thus, firm H will invest in the new project rather than repurchase shares.

- If firm L repurchases shares, equations (3), (9), and (15) are compared to find firm H's best response.

Subtracting (3) from (9) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$, which is positive. Hence, firm H will not choose to pay dividends.

Subtracting (9) from (15) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3B$$

Therefore, firm H will invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right]$ but choose to repurchase shares if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right]$.

- If firm L invests in the new project, equations (5), (11), and (17) are compared to find firm H's best response. Subtracting (5) from (11) yields $\alpha w_1(Y_H - Y_L)$, which is obviously positive. Hence, firm H will not choose to pay dividends. Subtracting (11) from (17) yields $\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2Xr_H\right] + w_3B$, which is positive. Thus, firm H will choose to invest in the new project.

- If firm H repurchase shares, equations (8), (10), and (12) are compared to find firm L's best response. Subtracting (8) from (10) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right)\right]$, which is positive. Hence, firm L will not choose to pay dividends. Subtracting (10) from (12) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + Xr_L\right)\right] + w_3 B$$

Therefore, firm L will invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 4Xr_L\right]$ but repurchase shares if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 4Xr_L\right]$.

- If firm H invests in the new project, equations (14), (16), and (18) are compared to find firm L's best response. Subtracting (14) from (16) yields $\alpha\left[w_1(Y_H - Y_L) + w_2 X\left(\frac{Y_L - Y_H}{Y_H}\right)\right]$, which is positive. Hence, firm L will not choose to pay dividends.

Subtracting (16) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right)\right] + w_3 B$$

Thus, firm L will invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$ but repurchase shares if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$.

Proof of Lemma 6

(a) If firm L pays dividends, equations (19), (25), and (31) are compared to find firm H's best response. Subtracting (19) from (31) yields $\alpha\left[\left(w_1\left(\frac{Y_H - Y_L}{2}\right) + Xr_H\right) + w_2 Xr_H\right] + w_3 B$, which is positive. Hence, firm H will choose to invest in the new project rather than pay dividends.

Subtracting (25) from (31) yields

$$\alpha\left[w_1\left(\left(\frac{Y_H - Y_L}{2}\right) + Xr_H\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B \qquad \text{(P13)}$$

Given assumption (a1), (P13) is positive. Thus, firm H will choose to invest in the new project rather than repurchase shares.

(b) If firm L repurchases shares, equations (21), (27), and (33) are compared to find firm H's best response. Subtracting (21) from (27) yield $\alpha w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

Subtracting (27) from (33) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B \qquad \text{(P14)}$$

Given that $w_1 = w_2 = w_3 = 1/3$, and $r_H + r_L = 0$, (P14) becomes

$$\frac{\alpha}{2}\left[\left(\frac{Y_L - Y_H}{2}\right) + X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right)\right] + w_3 B \qquad \text{(P15)}$$

Hence, firm H chooses to invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$, but choose to repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$.

(c) If firm L invests in the new project, equations (23), (29), and (35) are compared to find firm H's best response. Subtracting (23) from (35) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X r_H\right] + w_3 B$, which is positive. Thus, firm H will choose to invest in the new project rather than pay dividends.

Subtracting (29) from (35) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2 X r_H\right] + w_3 B \tag{P16}$$

Given $w_1 = w_2 = w_3 = 1/3$ and assumption (a1), (P16) is positive. Therefore, firm H chooses to invest in the new project rather than repurchase shares. ■

Proof of Lemma 7

(a) If firm H repurchases shares, equations (26), (28), and (30) are compared to find firm L's best response. Subtracting (28) from (26) yields $\alpha w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is obviously positive. Hence, firm L will choose to pay dividends rather than repurchase shares.

Subtracting (26) from (30) yields

$$\alpha\left[\left(w_1\left(\frac{Y_L - Y_H}{2}\right) + X r_L\right) + w_2 X r_L\right] + w_3 B \tag{P17}$$

Substituting $w_1 = w_2 = w_3 = 1/3$ into (P17) yields

$$\frac{\alpha}{3}\left[\left(\frac{Y_L - Y_H}{2}\right) + 2Xr_L\right] + \frac{B}{3} \tag{P18}$$

Thus, firm L will invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - 2Xr_L\right]$ but pay dividends if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) - 2Xr_L\right]$.

(b) If firm H invests in the new project, equations (32), (34), and (36) are compared to find firm L's best response.

Subtracting (32) from (34) yields

$$\alpha\left[w_1\left(Y_H - Y_L\right) + w_2 X\left(\frac{Y_L - Y_H}{Y_H}\right)\right] \tag{P19}$$

Given assumption (a1), (P19) is positive. Hence, firm L will choose to repurchase shares rather than pay dividends.

Subtracting (34) from (36) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right)\right] + w_3 B \tag{P20}$$

Substituting $w_1 = w_2 = w_3 = 1/3$ into (P20) yields

$$\frac{\alpha}{3}\left[\left(\frac{Y_L - Y_H}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right] + \frac{B}{3} \tag{P21}$$

Hence, firm L will choose to invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_L - Y_H}{Y_H}\right) - Xr_L\right]$ but choose to repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_L - Y_H}{Y_H}\right) - Xr_L\right]$.■

Proof of Corollary 4

Substituting $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$ into equations (19) to (36), I re-analyse the equilibrium as follows:

- If firm L pays dividends, equations (19), (25), and (31) are compared to find firm H's best response. Subtracting (19) from (31) yields $\alpha\left[\left(w_1\left(\frac{Y_H - Y_L}{2}\right) + Xr_H\right) + w_2 Xr_H\right] + w_3 B$, which is positive. Hence, firm H will choose to invest in the new project rather than pay dividends.

  Subtracting (25) from (31) yields

  $$\alpha\left[w_1\left(\left(\frac{Y_H - Y_L}{2}\right) + Xr_H\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B \qquad \text{(P22)}$$

  Given assumption (a1), (P22) is positive. Thus, firm H will choose to invest in the new project rather than repurchase shares.

- If firm L repurchases shares, equations (21), (27), and (33) are compared to find firm H's best response. Subtracting (21) from (27) yield $\alpha w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

  Subtracting (27) from (33) yields

  $$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B \qquad \text{(P23)}$$

Given that $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$, firm H will choose to invest in the new project if $B \geq 3\alpha\left[\left(Y_H - Y_L\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_L\right]$, but choose to repurchase shares if $B < \alpha\left[\left(Y_H - Y_L\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_L\right]$.

- If firm L invests in the new project, equations (23), (29), and (35) are compared to find firm H's best response. Subtracting (23) from (35) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 Xr_H\right] + w_3 B$, which is positive. Thus, firm H will choose to invest in the new project rather than pay dividends.

Subtracting (29) from (35) yields $\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2 Xr_H\right] + w_3 B$, which is positive. Therefore, firm H chooses to invest in the new project rather than repurchase shares.

- If firm H repurchases shares, equations (26), (28), and (30) are compared to find firm L's best response. Subtracting (28) from (26) yields $\alpha w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is obviously positive. Hence, firm L will choose to pay dividends rather than repurchase shares.

Subtracting (26) from (30) yields $\alpha\left[\left(w_1\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2 Xr_L\right] + w_3 B$.

Given that $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$, firm L will invest in the new project if $B \geq 3\alpha\left[\left(Y_H - Y_L\right) - 3Xr_L\right]$ but pay dividends if $B < 3\alpha\left[\left(Y_H - Y_L\right) - 3Xr_L\right]$.

- If firm H invests in the new project, equations (32), (34), and (36) are compared to find firm L's best response.

Subtracting (32) from (34) yields

$$\alpha\left[w_1\left(Y_H - Y_L\right) + w_2 X\left(\frac{Y_L - Y_H}{Y_H}\right)\right] \tag{P24}$$

Given assumption (a1), (P24) is positive. Hence, firm *L* will choose to repurchase shares rather than pay dividends.

Subtracting (34) from (36) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right)\right] + w_3 B\,.$$

Given that $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$, firm *L* will choose to invest in the new project if $B \geq 3\alpha\left[\left(Y_H - Y_L\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$ but choose to repurchase shares if $B < 3\alpha\left[\left(Y_H - Y_L\right) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$.■

Proof of Corollary 5

Substituting $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$ into equations (19) to (36), I re-analyse the equilibrium as follows:

- If firm *L* pays dividends, equations (19), (25), and (31) are compared to find firm *H*'s best response. Subtracting (19) from (31) yields $\alpha\left[\left(w_1\left(\frac{Y_H - Y_L}{2}\right) + Xr_H\right) + w_2 Xr_H\right] + w_3 B$, which is positive. Hence, firm *H* will choose to invest in the new project rather than pay dividends.

  Subtracting (25) from (31) yields

$$\alpha\left[w_1\left(\left(\frac{Y_H - Y_L}{2}\right) + Xr_H\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B \qquad \text{(P25)}$$

Given assumption (a1), (P25) is positive. Thus, firm H will choose to invest in the new project rather than repurchase shares.

- If firm L repurchases shares, equations (21), (27), and (33) are compared to find firm H's best response. Subtracting (21) from (27) yields $\alpha w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

Subtracting (27) from (33) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B \qquad \text{(P26)}$$

Given that $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$, firm H will choose to invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right]$, but choose to repurchase shares if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right]$.

- If firm L invests in the new project, equations (23), (29), and (35) are compared to find firm H's best response. Subtracting (23) from (35) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 Xr_H\right] + w_3 B$, which is positive. Thus, firm H will choose to invest in the new project rather than pay dividends.

Subtracting (29) from (35) yields $\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2 X r_H\right] + w_3 B$, which is positive. Therefore, firm *H* chooses to invest in the new project rather than repurchase shares.

- If firm *H* repurchases shares, equations (26), (28), and (30) are compared to find firm *L*'s best response. Subtracting (28) from (26) yields $\alpha w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)$, which is obviously positive. Hence, firm *L* will choose to pay dividends rather than repurchase shares.

Subtracting (26) from (30) yields $\alpha\left[\left(w_1\left(\frac{Y_L - Y_H}{2}\right) + X r_L\right) + w_2 X r_L\right] + w_3 B$.

Given that $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$, firm *L* will invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 4 X r_L\right]$ but pay dividends if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 4 X r_L\right]$.

- If firm *H* invests in the new project, equations (32), (34), and (36) are compared to find firm *L*'s best response.

Subtracting (32) from (34) yields

$$\alpha\left[w_1\left(Y_H - Y_L\right) + w_2 X\left(\frac{Y_L - Y_H}{Y_H}\right)\right] \tag{P26}$$

Given assumption (a1), (P26) is positive. Hence, firm *L* will choose to repurchase shares rather than pay dividends.

Subtracting (34) from (36) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + X r_L\right)\right] + w_3 B.$$

Given that $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$, firm L will choose to invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$ but choose to repurchase shares if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$.■

Proof of Lemma 8

(a) If firm L pays dividends, equations (1), (7), and (13) are compared to find firm H's best response. Subtracting (1) from (7) yields $\alpha w_1\left(\frac{Y_H - Y_L}{2}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends. Subtracting (7) from (13) yields $\alpha Xr_H + w_3 B$.Given assumption (a2), firm H will repurchase shares rather than invest in the new project.

(b) If firm L repurchases shares, equations (3), (9), and (15) are compared to find firm H's best response.

Subtracting (3) from (9) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

Subtracting (9) from (15) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B \qquad \text{(P21)}$$

Given that $w_1 = w_2 = w_3 = 1/3$, (P21) becomes

$$\frac{\alpha}{3}\left[\left(\frac{Y_L - Y_H}{2}\right) + Xr_L + X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right] + \frac{B}{3} \qquad \text{(P22)}$$

Hence, firm H chooses to invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_H - Xr_L\right]$, but choose to repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_H - Xr_L\right]$.

(c) If firm L invests in the new project, equations (5), (11), and (17) are compared to find firm H's best response.

Subtracting (5) from (11) yields $\alpha w_1(Y_H - Y_L)$, which is obviously positive. Thus, firm H will choose to repurchase shares rather than pay dividends.

Subtracting (11) from (17) yields $\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2 Xr_H\right] + w_3 B$, which is negative. Thus, H will choose to repurchase shares rather than invest in the new project.

Proof of Lemma 9

(a) If firm H repurchases shares, equations (8), (10), and (12) are compared to find firm L's best response.

Subtracting (8) from (12) yields $\alpha Xr_L + w_3 B$. Given assumption (a2), firm L will choose to invest in the new project rather than pay dividends.

Subtracting (10) from (12) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + Xr_L\right)\right] + w_3 B \qquad \text{(P23)}$$

Substituting $w_1 = w_2 = w_3 = 1/3$ into (P23) yields

$$\frac{\alpha}{3}\left[\left(\frac{Y_L - Y_H}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + 2Xr_L\right] + \frac{B}{3} \qquad \text{(P24)}$$

Hence, firm L will choose to invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) - 2Xr_L\right]$ but repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) - 2Xr_L\right]$.

(b) If firm H invests in the new project, equations (14), (16), and (18) are compared to find firm L's best response.

Subtracting (14) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 Xr_L\right] + w_3 B \qquad \text{(P25)}$$

Given assumption (a2), (P25) is positive. Thus, firm L will choose to invest in the new project rather than pay dividends.

Subtracting (16) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right)\right] + w_3 B \qquad \text{(P26)}$$

Substituting $w_1 = w_2 = w_3 = 1/3$ into (P26) yields

$$\frac{\alpha}{3}\left[\left(\frac{Y_L - Y_H}{2}\right) + X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right] + \frac{B}{3} \qquad \text{(P27)}$$

Hence, firm L will choose to invest in the new project if $B \geq \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_L - Y_H}{Y_H}\right) - Xr_L\right]$ but repurchase shares if $B < \alpha\left[\left(\frac{Y_H - Y_L}{2}\right) + X\left(\frac{Y_L - Y_H}{Y_H}\right) - Xr_L\right]$ ■

Proof of Corollary 6

- If firm L pays dividends, equations (1), (7), and (13) are compared to find firm H's best response. Subtracting (1) from (7) yields $\alpha w_1\left(\frac{Y_H - Y_L}{2}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends. Subtracting (7) from (13) yields $\alpha Xr_H + w_3 B$.Given assumption (a2), firm H will repurchase shares rather than invest in the new project.

- If firm L repurchases shares, equations (3), (9), and (15) are compared to find firm H's best response.

  Subtracting (3) from (9) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

  Subtracting (9) from (15) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + Xr_H\right)\right] + w_3 B \qquad \text{(P28)}$$

Given that $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$, firm H will chooses to invest in the new project if $B \geq 3\alpha\left[\left(Y_H - Y_L\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_H - 2Xr_L\right]$, but choose to repurchase shares if $B < 3\alpha\left[\left(Y_H - Y_L\right) + X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - Xr_H - 2Xr_L\right]$.

- If firm L invests in the new project, equations (5), (11), and (17) are compared to find firm H's best response.

  Subtracting (5) from (11) yields $\alpha w_1\left(Y_H - Y_L\right)$, which is obviously positive. Thus, firm H will choose to repurchase shares rather than pay dividends.

  Subtracting (11) from (17) yields $\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2 Xr_H\right] + w_3 B$, which is negative. Thus, H will choose to repurchase shares rather than invest in the new project.

- If firm H repurchases shares, equations (8), (10), and (12) are compared to find firm L's best response.

  Subtracting (8) from (12) yields $\alpha Xr_L + w_3 B$. Given assumption (a2), firm L will choose to invest in the new project rather than pay dividends.

  Subtracting (10) from (12) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + Xr_L\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + Xr_L\right)\right] + w_3 B$$

Given that $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$, firm L will choose to invest in the new project if $B \geq 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$ but repurchase shares if $B < 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2Xr_L\right]$.

- If firm H invests in the new project, equations (14), (16), and (18) are compared to find firm L's best response.

Subtracting (14) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 Xr_L\right] + w_3 B \tag{P29}$$

Given assumption (a2), (P29) is positive. Thus, firm L will choose to invest in the new project rather than pay dividends.

Subtracting (16) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right)\right] + w_3 B$$

Given that $w_1 = 0.6, w_2 = 0.3, w_3 = 0.1$, firm L will chooses to invest in the new project if $B \geq 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$ but repurchase shares if $B < 3\alpha\left[(Y_H - Y_L) - X\left(\frac{Y_H - Y_L}{Y_H}\right) - Xr_L\right]$ ■

Proof of Corollary 7

- If firm L pays dividends, equations (1), (7), and (13) are compared to find firm H's best response. Subtracting (1) from (7) yields $\alpha w_1\left(\frac{Y_H - Y_L}{2}\right)$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends. Subtracting (7) from (13) yields $\alpha X r_H + w_3 B$. Given assumption (a2), firm H will repurchase shares rather than invest in the new project.

- If firm L repurchases shares, equations (3), (9), and (15) are compared to find firm H's best response.

  Subtracting (3) from (9) yields $\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right)\right]$, which is obviously positive. Hence, firm H will choose to repurchase shares rather than pay dividends.

  Subtracting (9) from (15) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + X r_L\right) + w_2\left(X\left(\frac{Y_L - Y_H}{Y_H + Y_L}\right) + X r_H\right)\right] + w_3 B$$

  Given that $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$, firm H will chooses to invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2X r_H\right]$, but choose to repurchase shares if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) + 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 2X r_H\right]$.

- If firm L invests in the new project, equations (5), (11), and (17) are compared to find firm H's best response.

Subtracting (5) from (11) yields $\alpha w_1(Y_H - Y_L)$, which is obviously positive. Thus, firm H will choose to repurchase shares rather than pay dividends.

Subtracting (11) from (17) yields $\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2 X r_H\right] + w_3 B$, which is negative. Thus, H will choose to repurchase shares rather than invest in the new project.

- If firm H repurchases shares, equations (8), (10), and (12) are compared to find firm L's best response.

Subtracting (8) from (12) yields $\alpha X r_L + w_3 B$. Given assumption (a2), firm L will choose to invest in the new project rather than pay dividends.

Subtracting (10) from (12) yields

$$\alpha\left[w_1\left(\left(\frac{Y_L - Y_H}{2}\right) + X r_L\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) + X r_L\right)\right] + w_3 B$$

Given that $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$, firm L will choose to invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 4 X r_L\right]$ but repurchase shares if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H + Y_L}\right) - 4 X r_L\right]$.

- If firm H invests in the new project, equations (14), (16), and (18) are compared to find firm L's best response.

Subtracting (14) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_H - Y_L}{2}\right) + w_2 X r_L\right] + w_3 B \qquad \text{(P30)}$$

Given assumption (a2), (P30) is positive. Thus, firm L will choose to invest in the new project rather than pay dividends.

Subtracting (16) from (18) yields

$$\alpha\left[w_1\left(\frac{Y_L - Y_H}{2}\right) + w_2\left(X\left(\frac{Y_H - Y_L}{Y_H}\right) + Xr_L\right)\right] + w_3 B$$

Given that $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$, firm L will chooses to invest in the new project if $B \geq \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$ but repurchase shares if $B < \frac{\alpha}{6}\left[\left(\frac{Y_H - Y_L}{2}\right) - 3X\left(\frac{Y_H - Y_L}{Y_H}\right) - 3Xr_L\right]$ ■

Appendix B

Proof of Lemma 1

Given that firm *H* pays dividends, equations (5), (19), and (13) are compared in order to find firm *L*'s best response.

Subtracting (13) from (5) yields $(Z^H - Z^L) + (I - X^L) + 2\lambda^D - B$. Given assumption (a1), firm *L* will choose to pay dividends rather than invest in the new project.

Subtracting (19) from (5) yields $(Z^H - Z^L) + \lambda^R - 2\lambda^D$. Thus, firm *L* chooses to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$.

Given that firm *H* repurchase shares, equations (17), (7), and (15) are compared in order to find firm *L*'s best response.

Subtracting (17) from (15) yields $(X^L - I) + B - 2\lambda^D$. Given assumption (a1), firm *L* will choose to pay dividends rather than invest in the new project.

Subtracting (7) from (17) yields $(Z^H - Z^L) + \lambda^R - 2\lambda^D$. Thus, firm *L* chooses to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$.

Given that firm *H* invests in the new project, equations (9), (11), and (3) are compared in order to find firm *L*'s best response.

Subtracting (3) from (9) yields $(Z^H - Z^L) + (I - X^L) + 2\lambda^D - B$. Given assumption (a1), firm *L* will choose to pay dividends rather than invest in the new project.

Subtracting (11) from (9) yields $2\lambda^D - \lambda^R$. Thus, firm L pays dividends if $\lambda^D \geq \frac{\lambda^R}{2}$ but repurchase shares if $\lambda^D < \frac{\lambda^R}{2}$. ■

Proof of Lemma 2

Given that firm L pays dividends, equations (4), (16), and (8) are compared to find firm H's best responses.

Subtracting (8) from (4) yields $(Z^H - Z^L) + 2\lambda^D - (X^H - I) - B$. Thus, firm H will pay dividends if $(Z^H - Z^L) + 2\lambda^D \geq (X^H - I) + B$ but invest in the new project if $(Z^H - Z^L) + 2\lambda^D < (X^H - I) + B$.

Subtracting (8) from (16) yields $(Z^H - Z^L) + 2\lambda^R - (X^H - I) - B$. Thus, firm H will repurchase shares if $(Z^H - Z^L) + \lambda^R \geq (X^H - I) + B$ but invest in the new project if $(Z^H - Z^L) + \lambda^R < (X^H - I) + B$.

Subtracting (4) from (16) yields $(Z^H - Z^L) - 2\lambda^D + \lambda^R$. Thus, firm H will choose to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$.

Given that firm L repurchases shares, equations (18), (6), and (10) are compared to find firm H's best responses.

Subtracting (18) from (10) yields $(X^H - I) + B - 2\lambda^D$. Thus, firm H will choose to pay dividends if $2\lambda^D \geq (X^H - I) + B$ but invest in the new project if $2\lambda^D < (X^H - I) + B$.

Subtracting (6) from (10) yields $\left(Z^L - Z^H\right) - \lambda^R + \left(X^H - I\right) + B$. Thus, firm H will choose to repurchase shares if $\left(Z^H - Z^L\right) + \lambda^R \geq \left(X^H - I\right) + B$ but invest in the new project if $\left(Z^H - Z^L\right) + \lambda^R < \left(X^H - I\right) + B$.

Subtracting (6) from (18) yields $\left(Z^L - Z^H\right) + 2\lambda^D - \lambda^R$. Thus, firm H will choose to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{2}$. ■

Proof of Corollary 1

To analyse the effects of managerial myopia on equilibrium, I substitute $w_1 = 0.6, w_2 = 0.3, w_1 = 0.1$ into managerial payoffs and compare them as follows:

Given that firm H pays dividends, equations (5), (19), and (13) are compared to find firm L's best responses as follows:

Subtracting (13) from (5) yields $0.9\left(\frac{Z^H - Z^L}{2}\right) + 0.3\left(I - X^L\right) + 0.9\lambda^D - 0.1B$. Given assumption (a1), firm L will choose to pay dividends rather than invest in the new project.

Subtracting (19) from (5) yields $0.9\left(\frac{Z^H - Z^L}{2}\right) + 0.3\lambda^R - 0.9\lambda^D$. Thus, firm L chooses to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$.

Given that firm H repurchase shares, equations (17), (7), and (15) are compared in order to find firm L's best response.

Subtracting (17) from (15) yields $0.3\left(X^L - I\right) + 0.1B - 0.9\lambda^D$. Given assumption (a1), firm L will choose to pay dividends rather than invest in the new project.

Subtracting (7) from (17) yields $0.9\left(\frac{Z^H - Z^L}{2}\right) + 0.3\lambda^R - 0.9\lambda^D$. Thus, firm L chooses to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$.

Given that firm H invests in the new project, equations (9), (11), and (3) are compared in order to find firm L's best response.

Subtracting (3) from (9) yields $0.9\left(\frac{Z^H - Z^L}{2}\right) + 0.3\left(I - X^L\right) + 0.9\lambda^D - 0.1B$. Given assumption (a1), firm L will choose to pay dividends rather than invest in the new project.

Subtracting (11) from (9) yields $0.9\lambda^D - 0.3\lambda^R$. Thus, firm L pays dividends if $\lambda^D \geq \frac{\lambda^R}{3}$ but repurchase shares if $\lambda^D < \frac{\lambda^R}{3}$.

Given that firm L pays dividends, equations (4), (16), and (8) are compared to find firm H's best responses.

Subtracting (8) from (4) yields $0.9\left(\frac{Z^H - Z^L}{2}\right) + 0.9\lambda^D - 0.3(X^H - I) - 0.1B$. Thus, firm H will pay dividends if $9\left(\frac{Z^H - Z^L}{2}\right) + 9\lambda^D \geq 3(X^H - I) + B$ but invest in the new project if $9\left(\frac{Z^H - Z^L}{2}\right) + 9\lambda^D < 3(X^H - I) + B$.

Subtracting (8) from (16) yields $0.9(Z^H - Z^L) + 0.3\lambda^R - 0.3(X^H - I) - 0.1B$. Thus, firm H will repurchase shares if $9(Z^H - Z^L) + 3\lambda^R \geq 3(X^H - I) + B$ but invest in the new project if $9(Z^H - Z^L) + 3\lambda^R < 3(X^H - I) + B$.

Subtracting (4) from (16) yields $0.9(Z^H - Z^L) - 0.9\lambda^D + 0.3\lambda^R$. Thus, firm H will choose to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$.

Given that firm L repurchases shares, equations (18), (6), and (10) are compared to find firm H's best responses.

Subtracting (18) from (10) yields $0.3(X^H - I) + 0.1B - 0.9\lambda^D$. Thus, firm H will choose to pay dividends if $9\lambda^D \geq 3(X^H - I) + B$ but invest in the new project if $9\lambda^D < 3(X^H - I) + B$.

Subtracting (6) from (10) yields $0.9\left(\frac{Z^L - Z^H}{2}\right) - 0.3\lambda^R + 0.3(X^H - I) + 0.1B$. Thus, firm H will choose to repurchase shares if $9\left(\frac{Z^H - Z^L}{2}\right) + 3\lambda^R \geq 3(X^H - I) + B$ but invest in the new project if $9\left(\frac{Z^H - Z^L}{2}\right) + 3\lambda^R < 3(X^H - I) + B$.

Subtracting (6) from (18) yields $0.9\left(\frac{Z^L - Z^H}{2}\right) + 0.9\lambda^D - 0.3\lambda^R$. Thus, firm H will choose to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{\lambda^R}{3}$. ■

Proof of Corollary 2

To analyse the effects of managerial farsightedness on equilibrium, I substitute $w_1 = 0.1, w_2 = 0.3, w_3 = 0.6$ into managerial payoffs and compare them as follows:

Given that firm H pays dividends, equations (5), (19), and (13) are compared to find firm L's best responses as follows:

Subtracting (13) from (5) yields $0.4\left(\frac{Z^H - Z^L}{2}\right) + 0.3\left(I - X^L\right) + 0.4\lambda^D - 0.6B$. Given assumption (a1), firm L will choose to pay dividends rather than invest in the new project.

Subtracting (19) from (5) yields $0.4\left(\frac{Z^H - Z^L}{2}\right) + 0.3\lambda^R - 0.4\lambda^D$. Thus, firm L chooses to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$.

Given that firm H repurchase shares, equations (17), (7), and (15) are compared in order to find firm L's best response.

Subtracting (17) from (15) yields $0.3\left(X^{L}-I\right)+0.6B-0.4\lambda^{D}$. Given assumption (a1), firm L will choose to pay dividends rather than invest in the new project.

Subtracting (7) from (17) yields $0.4\left(\dfrac{Z^{H}-Z^{L}}{2}\right)+0.3\lambda^{R}-0.4\lambda^{D}$. Thus, firm L chooses to pay dividends if $\lambda^{D}\geq\left(\dfrac{Z^{H}-Z^{L}}{2}\right)+\dfrac{3}{4}\lambda^{R}$ but repurchase shares if $\lambda^{D}<\left(\dfrac{Z^{H}-Z^{L}}{2}\right)+\dfrac{3}{4}\lambda^{R}$.

Given that firm H invests in the new project, equations (9), (11), and (3) are compared in order to find firm L's best response.

Subtracting (3) from (9) yields $0.4\left(\dfrac{Z^{H}-Z^{L}}{2}\right)+0.3\left(I-X^{L}\right)+0.4\lambda^{D}-0.6B$. Given assumption (a1), firm L will choose to pay dividends rather than invest in the new project.

Subtracting (11) from (9) yields $0.4\lambda^{D}-0.3\lambda^{R}$. Thus, firm L pays dividends if $\lambda^{D}\geq\dfrac{3}{4}\lambda^{R}$ but repurchase shares if $\lambda^{D}<\dfrac{3}{4}\lambda^{R}$.

Given that firm L pays dividends, equations (4), (16), and (8) are compared to find firm H's best responses.

Subtracting (8) from (4) yields $0.4\left(\dfrac{Z^{H}-Z^{L}}{2}\right)+0.4\lambda^{D}-0.3\left(X^{H}-I\right)-0.6B$. Thus, firm H will pay dividends if $2\left(Z^{H}-Z^{L}\right)+4\lambda^{D}\geq 3\left(X^{H}-I\right)+6B$ but invest in the new project if $2\left(Z^{H}-Z^{L}\right)+4\lambda^{D}\geq 3\left(X^{H}-I\right)+6B$.

Subtracting (8) from (16) yields $0.4\left(Z^H - Z^L\right) + 0.3\lambda^R - 0.3\left(X^H - I\right) - 0.6B$. Thus, firm H will repurchase shares if $4\left(Z^H - Z^L\right) + 3\lambda^R \geq 3\left(X^H - I\right) + 6B$ but invest in the new project if $4\left(Z^H - Z^L\right) + 3\lambda^R < 3\left(X^H - I\right) + 6B$.

Subtracting (4) from (16) yields $0.4\left(\frac{Z^H - Z^L}{2}\right) - 0.4\lambda^D + 0.3\lambda^R$. Thus, firm H will choose to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$.

Given that firm L repurchases shares, equations (18), (6), and (10) are compared to find firm H's best responses.

Subtracting (18) from (10) yields $0.3\left(X^H - I\right) + 0.6B - 0.4\lambda^D$. Thus, firm H will choose to pay dividends if $4\lambda^D \geq 3\left(X^H - I\right) + 6B$ but invest in the new project if $4\lambda^D < 3\left(X^H - I\right) + 6B$.

Subtracting (6) from (10) yields $0.4\left(\frac{Z^L - Z^H}{2}\right) - 0.3\lambda^R + 0.3\left(X^H - I\right) + 0.6B$. Thus, firm H will choose to repurchase shares if $2\left(Z^H - Z^L\right) + 3\lambda^R \geq 3\left(X^H - I\right) + 6B$ but invest in the new project if $2\left(Z^H - Z^L\right) + 3\lambda^R < 3\left(X^H - I\right) + 6B$.

Subtracting (6) from (18) yields $0.4\left(\frac{Z^L - Z^H}{2}\right) + 0.4\lambda^D - 0.3\lambda^R$. Thus, firm H will choose to pay dividends if $\lambda^D \geq \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$ but repurchase shares if $\lambda^D < \left(\frac{Z^H - Z^L}{2}\right) + \frac{3}{4}\lambda^R$. ■

Appendix C

An Example of Share Repurchase Disclosure Form

Electricity Generating Public Company Limited

December 17, 2001

We, Electricity Generating Public Company Limited, hereby notify the resolution of the Executive Committee, no. 17/2001, held on December 15, 2001, regarding the approval on the proposed share repurchase for financial management purposes. According to the resolution of the Board of Directors, no 6/2001, held on October 29, 2001, approved, in principle, the implementation of the Treasury Stock and authorized the Executive Committee to determine the details of the treasury stock plan. The details are as follows:

1. The share repurchase project

1.1 The maximum amount for the share repurchase is Baht 1,500 million. (One thousand and five hundred million Baht)

1.2 Number of shares repurchased not exceed 42.86 million shares (at par value Baht 10 per share) or equal to 8.16 % of the total of paid-up capital.

1.3 Procedure used for the repurchasing of shares

../.. on the Stock Exchange of Thailand

..... offer to general shareholders at the price of ... baht per share (the price being the same)

The repurchase period will be started from January 2, 2002 to July 1, 2002

Remarks: The company has to disclose the proposed share repurchase not later than 14 days prior to the date on which the shares will be repurchased

1. The implementation period shall not exceed 6 months when a share repurchase scheme is by way of purchasing from the SET.

2. The repurchase period shall not be less than 10 days and shall not exceed 20 days in the case where the offering is from the general shareholders.

1.4 The principle used to determine the repurchase price taking into account the average market price during the last 30 days prior to the date on which the company discloses the information of shares repurchase.

The share repurchase price is determined by using a conservative approach. The methodology is as follows:

Dividend Discount Method (Only from Existing Projects)

This valuation approach only takes into consideration the return on equity in terms of dividend receipt throughout the projects' lives. Cost of Equity is the discount factor used to calculate the NPV. Herein, to arrive to the Company valuation we have taken into consideration the dividend received throughout the tenure of the PPA agreement for each respective Company (Subsidiaries & Affiliate Companies) in terms of percentage investment held. Hence, the average market price during the last 30 days, since November 1, 2001 until December 14, 2001 is 33.98 Baht.

2. The information of the company

2.1 The company's retained earning and excess liquidity is based on the Financial Statement as of September 30, 2001

- The company's retained earning is Baht 3,978.81 million.

- The company's debts, which shall become due within the 6 months including its interest following from the date on which the shares will be repurchased, is equal to Baht 743 million

- The basis for this ability to repay the above mentioned debts and the source of funds for the repayment

The Company has a consistent profitability record, where the Company reported net profit in the amount of Baht 2,647.95 million and Baht 1,216.74 million in the year 1999 and 2000, respectively. The Company reported Retained Earnings, as of September 30, 2001 is Baht 3,978.81 million. As of September 30, 2001, the Company has total debt to equity ratio at 0.26 times, where its debts from the 5-year debenture amount to Baht 4,457.35 million. The tenure of the debenture is for 5 years and time to maturity is 3 years. The principal and interest are payable semi-annually in two instalments in the month of April and October respectively.

Since the date of share buyback (from January 2 to July 1, 2002), the Company is scheduled to service the debt liability for its Thai Baht Debenture, on the April 21 2002, amounting to Baht 743 million. As of September 30, 2001, the Company has Liquid Assets amounting to Baht 4,829.65 million, which consists of Cash amounting to 2,461.76 million. Hence, a share buyback will not have any negative impact on the financial stability of the Company.

2.2 The number of minor shareholders (Free float) as in the share registration book finalized on September 11, 2001 equal to 278,802,900 shares or 53.02% of the company's paid up capital. In addition, the company encloses herewith the report of the company's share distribution.

3. Reasons for the proposed share repurchase

The Executive Committee meeting, no 17/2001, held on December 15, 2001 has given their consent to the Company to buyback their shares to manage the excess cash of the Company since this would bring in better return on investment, as compared to other investment opportunities.

The Company believes that the current market price of its stock is below the fundamental value of the Company. Therefore, through a share buyback the Company would be in a position to reflect the real fundamental value of the Company. This reflects the confidence of the management in the Company with regard to its ability to generate strong cash flows and maintain consistent future growth. Besides this, the benefit to the shareholders is evident in a higher E.P.S. and higher Book Value per share.

The Executive Committee of the Company approve the share repurchase scheme, with an investment not exceeding Baht 1,500 million or which in term of shares repurchased does not exceed 42.86 million shares (that is not exceeding 8.16% of the total shares issued by the Company), which in either of the case does not exceed 10% of the total shares issued by the Company.

4. Likely impacts after the share repurchase.

4.1 Impact on the shareholders

The Company has a dividend pay out policy of approximately 40% of net profit. Thus, post share repurchase the shareholders would receive a higher dividend payment, since the number of shares outstanding would reduce by the number of shares repurchased and as such shares repurchased do not qualify for dividend payment. Therefore, this will increase the return on equity.

4.2 Impact on the company

The share repurchase will have impact on Cash and Book Value of the Company, where if the Company repurchases shares for Baht 1,500 million the liquid assets and book value will reduce by Baht 1,500 million.

5. The description of the resale of shares and of the shares written off.

- Procedure for shares resold

../.. on the Stock Exchange of Thailand

../.. by Public Offering

Remarks: The Company should resell the shares on the Stock Exchange of Thailand or by Public Offering, depends on the situation at that time of shares resold.

- Period for the resale of share is from January 2, 2003 to July 1, 2005 (after 6 months from the completion date of share repurchase and not later than 3 years from this time).

Remarks: The period for the resale of shares may be earlier than the above information in case of the repurchase period ended before July 1, 2002.

- Principle used to determine the resale price.

The Company has a policy to follow the regulations as per the Ministerial Regulations Re: Rules and Procedures for Share Repurchase, Disposition of Repurchased Shares and Shares Written Off in a Public Limited Company B.E. 2544, as follows:

The Company will dispose all the repurchased shares under from this scheme by offering them on the main board of Stock Exchange of Thailand or through general offering under the regulations of Stock Exchange of Thailand. The disposal period may start after 6 months from the completion date of the share repurchase scheme and the Company will dispose all the repurchase shares within 3 years. The Company will dispose all the repurchased shares prior to issuance of new shares. The price for disposal of shares will be based on the return on investment and the need of cash for future investments

In the event, the Company does not or is unable to dispose the repurchased shares within 3 years from the date of completion of the share repurchase the Company will reduce its capital by write off of the remaining unsold repurchased shares.

6. Shares repurchased in the past

- None -

The company certifies that the information contained in this report and attached documents are true and complete in all respects.

(Mr. Sitthiporn Ratanopas)

President & CEO

Note: Listed companies must report any resolutions of the board of directors regarding proposed projects for share repurchase on the date of the above mentioned meeting or up until 9.00am on the following day of business via facsimile and the Exchange's ELCID.